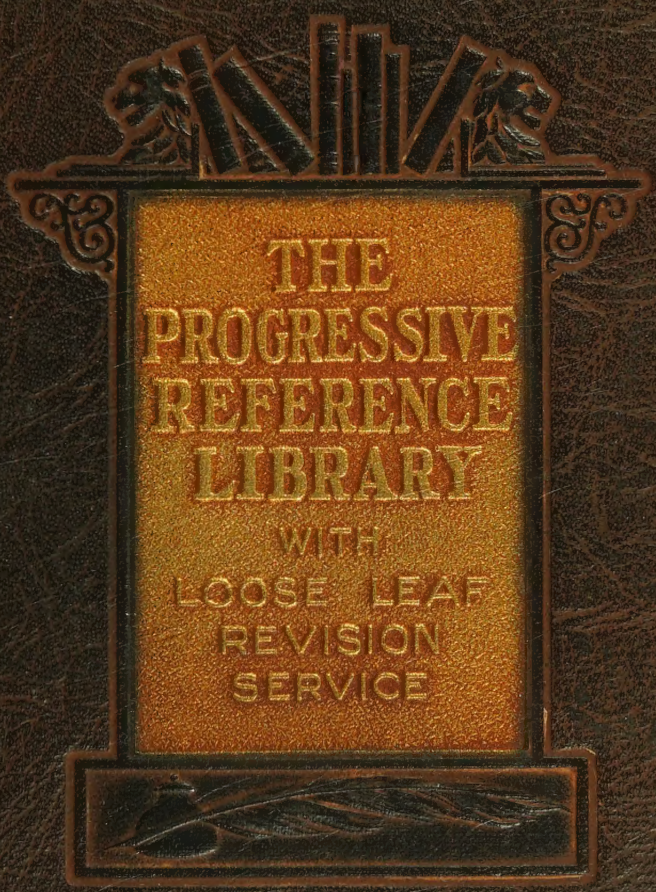
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DYEING, the art of fixing colors on linen, cotton, silk, wool, and other textile fabrics. Owing to a marked difference in which fibrous materials take color, it is necessary to pass the substances to be dyed through various preliminary operations. All matters preventing the dye from having free access, and the natural coloring that interferes with the production of the clear and bright tints, are removed. Bleaching is applied to linen and cotton fabrics before bringing them in contact with dyes, while silk is boiled to remove the fatty matter, and wool is scoured in soda, lye, diluted ammonia, or weak soap. The order in which substances have attraction for color is: wool, silk, cotton, flax, and hemp. Dyes are often applied to woolen goods before weaving, in which case they are called *wool-dyed.* If the coloring matter is applied after weaving, they are called *piece-dyed.* Some dyes will not adhere to the materials which are to be colored without an agent to fix them, that is, to cause a combination between the dyeing color and the stuff to be dyed. Such an agent is known as a *mordant.*

The dye materials used at present are derived from the mineral, vegetable, and animal kingdoms. The most common mineral dyes are known as arsenical greens, chrome yellow, cobalt blues, and Prussian blues. Vegetable dyes of different kinds are derived from Rubia tinctoria, munjeet, sandalwood, logwood, sappanwood, and Brazilwood. Animal dyes include those made from the cochineal insect and kindred species of insect life. In recent years aniline dyes derived from coal tar have been added to the list of coloring stuffs. Under various forms of treatment many organic substances yield coloring matter. Among them may be mentioned starch, lichens, wood, sawdust, cotton waste, mosses, soot, sugar, camwood, sumach, French berries, saffron, and turmeric.

DYER'S BROOM, or **Dyer's Weed,** a low and shrubby leguminous plant native to many parts of Europe. It has simple leaves and yellow flowers and is reputed to be the Genêt, a bush from which the Plantagenet family obtained its name. The tops are used in making a yellow dye, and it is said to possess medicinal properties useful in preventing hydrophobia. This plant has been naturalized in some parts of Canada and the United States.

DYNAMICS (dī-năm'īks), the science which treats of the action of forces. It is divided into statics and kinetics. *Statics* treats of forces that counterbalance each other, and which therefore produce no motion or change of motion; while *kinetics* treats of forces that do not counterbalance, and therefore cause motion or change of motion. The whole science is generally called *mechanics,* while dynamics is restricted to the branch commonly called kinetics. The three primary laws of force were first stated by Newton, and express the principal phenomena of mass motion. These are: 1. A body at rest will continue at rest, or a body in motion will continue in motion in a straight line with a uniform velocity, until acted on by some external force. 2. Any change in the direction or in the amount of motion is proportional to the force acting, and takes place in the direction in which the force acts. 3. Action and reaction are equal in amount and in opposite directions.

The first law is sometimes called the law of *inertia,* being a mere statement of the property of inertia. Matter at rest will continue at rest; or, if in motion, it must continue moving until it is acted on by some force, for the reason that it has no ability to start itself moving, to stop moving, or to change the direction of its motion. The second law states the principle that the amount and character of motion produced by any force depends upon the elements of a force. An equal force, acting on two masses, one twice as large as the other, imparts to the smaller mass a motion twice as great as to the larger. From this we notice that the amount of motion of a mass or body depends upon the quantity of matter the body contains, as well as upon the intensity of force causing its motion. The amount of motion a body possesses is called its *momentum,* which is equal to the mass of the body multiplied by its velocity. The principle declared in the third law is well illustrated by the recoil or kick of a gun, when a ball is shot from it. The motion in the gun is equal to that of the ball and is opposite in direction, but the actual velocity imparted to the gun is comparatively small on account of its mass being much greater than that of the ball. Hydrostatics is included in dynamics, when a wide construction is applied to the term.

DYNAMITE (dī'nă-mīt), a powerful explosive compound invented by Alfred Nobel, a German chemist, in 1867. The name is from a Greek word meaning strength. It was first produced by combining nitroglycerin with a siliceous earth obtained at Oberlohe, in Hanover, and known in Germany as *Kieselguhr.* Nitroglycerin was discovered by an Italian in 1846, but was not brought into practical use until the invention of dynamite. The proportion of nitroglycerin mixed with kieselguhr is seventy-five per cent., the mixture being made to diminish the liability of the nitroglycerin exploding by shock, and not destroying its force as an explosive. This earthy matter is highly porous and friable, thus containing high absorbent power. The color of dynamite is reddish-brown and has much the appearance of raw sugar. Other substances are now used to form dynamite, many being superior to kieselguhr for some purposes, among them diatomite, sand, charcoal, and sawdust.

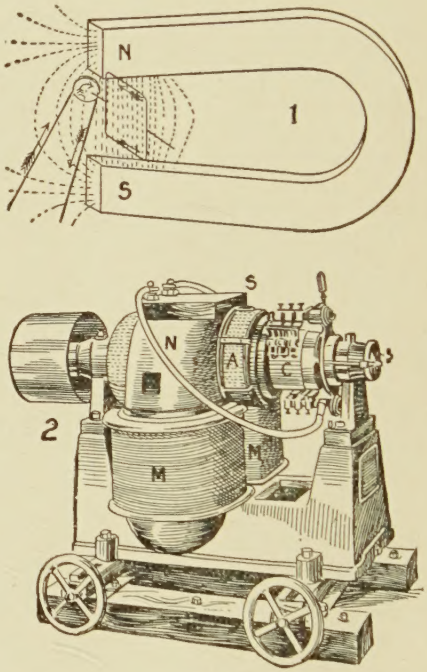
Dynamite is not impaired by age unless exposed to water. Small quantities may be

burned without danger and give off a yellowish flame, but an explosion results if it is heated to a high temperature. As an explosive force it is several times more powerful than gunpowder, the explosion being effected by a fulminating cap. It is used extensively for blasting bowlders and may be employed under water, though about six per cent. of its power is lost when exploded in a submerged state. On account of its tendency to break rock into particles, it is not used for quarrying, gunpowder still serving for that purpose. *Gun cotton* is a mixture of nitroglycerin and cotton or wood cellulose, and has the appearance of soft gelatin. It is used for some forms of tunneling and blasting in preference to dynamite, on account of giving off less fumes and having no tendency to cause headache to operators.

Dynamite has gone into use for firing guns in warfare, a dynamite gun suitable for that purpose having been invented in 1883. The dynamite gun made under the direction of Lieutenant Zalinski consists of a mechanism in which a tube from forty to sixty feet in length is utilized. This tube is supported by a truss frame to guard against warping by its own weight, and the dynamite projectiles are thrown from the tube by means of compressed air. The compressed air is stored in a chamber beneath the gun carriage, its pressure being usually 4,000 pounds, though not more than 2,000 pounds of effective pressure is applied in throwing the projectile. Usually the air is introduced back of the projectile at an effective pressure of 2,000 pounds, and is increased as the projectile moves forward in the tube, this being done as a safeguard against sudden explosion. By means of this arrangement dynamite projectiles may be thrown a distance of three miles, the destruction being effected when they explode by reason of the sudden jar with which they crash against a fortification or some other object at which they are aimed. Another dynamite gun is the Maxim-Schupphaus, in which a special powder starts the projectile with a low pressure and increases the velocity by maintaining pressure throughout the entire length of the gun. This gun belongs to the class that attracted attention and gave considerable satisfaction, though there are others that have been used more successfully in throwing dynamite projectiles and aërial torpedoes. Guns of this character were first successfully employed in actual battle during the attack on Santiago by the American forces in the war with Spain, but since then have had an extended use elsewhere.

DYNAMO ELECTRIC MACHINE, a machine for generating electricity by mechanical action, or for transforming electrical energy into mechanical energy. This is the definition of a dynamo-electric machine, which may serve either as a *generator* or a *motor*, depending upon whether it is supplied with mechanical or electrical energy; hence, whether it is giving out electrical or mechanical energy.

In Fig. 1 are shown the essential parts of a simple dynamo. Here the two magnetic poles, N S, of opposite polarity, are placed near to each other. Between the poles is a field of so-called lines of magnetic force, which are represented in the illustration by dotted lines. As the pulley C is revolved rapidly in the magnetic field, it cuts the lines of force and an electro-motive force is induced in the conductor. However, the magnitude of the electro-motive force in the conductor depends entirely upon the rate at which the lines are cut. Since one end of the conductor is raised to a higher electric potential than the other, owing to this electro-



DYNAMO.

motive force, there is a tendency for electricity to flow along the conductor. If the ends of the conductor are connected exterior to the magnetic field so as to form a closed circuit, a current will flow through it as is indicated by the two arrows in the illustration.

In a dynamo, as shown in Fig. 2 of the illustration, is an *armature*, A, of soft iron, around which a large number of wires are wrapped, the armature being revolved rapidly between the poles N and S of the large magnets M and M. By these means a current of electricity is induced which is conducted along the axis of the armature and taken up by brushes of metal and conducted over wires to the lamps or motor intended to be operated.

The *commutator*, C, is fixed on the collar

of the axis on which the armature revolves, and by means of it the direction of the current is reversed. In some machines the commutator causes the currents to be continuous or to have the same direction. The power of the machine depends upon the number of magnetic poles, within which the armature is moving, and the speed of rotation.

The effect of a dynamo is practically the same as that of a magneto-electric machine, but they differ in construction in that the latter has a permanent steel magnet instead of the electro-magnets used in dynamos. The dynamo is superior in that it possesses greater compactness, due to the fact that electro-magnets are stronger than permanent steel magnets of equal bulk. Their extensive use dates from the improvements made in their construction by Gramme of Paris in 1870. His invention became known as the Gramme machine, by means of which a powerful continuous current of uniform strength was obtained. Among the greatest dynamos ever built are those of Deptford Central Station, in London, and at Niagara Falls, the latter being propelled through the motive power of water wheels. At the Columbian Exposition there were twelve dynamos that weighed 900 tons, had a capacity of 180,000 lights, and were operated by engines with an aggregate of 12,000 horse power. Since then other notable dynamos have been constructed, those used at the London, England, exposition and the 11,000 horse power at Keokuk, Iowa, being noteworthy.

DYNAMOMETER (dī-nȧ-mŏm′ē-tēr), an instrument to ascertain the strength of men and animals, and to determine the power exerted by machines. Three classes of dynamometers are in use, including those designed to indicate the force of *thrust*, of *traction*, and of *rotation*. A thrust dynamometer is attached to the screw shaft of a steamship and measures the force of the screw in driving the vessel through the water. A simple traction dynamometer consists of a spring balance, in which the power exerted is indicated by an index upon a scale of figures. It may be fastened to a wagon or a plow, and when the team of horses pulls the load it shows the force exerted. The force of a shaft is measured by a rotary dynamometer, indicating the force transmitted by the shaft to other machinery.

DYNASTY (dĭ′nȧs-tў), a succession of sovereigns in one line of family descent, or derived from the same ancestral stock, and who govern the same country. Among the particularly noteworthy dynasties are the Hohenzollern of Germany, the Hapsburg of Austria, the Stuarts of England, and the Castile of Spain.

DYNE (dīn), the absolute unit of force, employed in the metric system for measuring force. It is termed the unit of the centimeter-gram-second system (C. G. S.), and is equal to a force that, acting upon one gram of matter for one second, will give it a velocity of one centimeter per second. Since the dyne is a small unit, it is more convenient to use the *megadyne*, which is equal to one million dynes.

DYSODILE (dĭs′ō-dīl), a mineral closely related to amber, found chiefly in limestone. It is of a yellowish or grayish color, and emits an odor similar to that of assafoetida when burning.

DYTICIDAE (dī-tĭs′i-dē), a family of water beetles which embrace nearly a thousand species. The body is flattened and the hind legs are furnished with hairs to aid in swimming. They pass the winter in a dormant state by being concealed in thick tufts of herbage or in mud, and become active in early spring. The antennae are smooth. Their habits are active, both in swimming and in flying from one pond to another.

DZIGGETAI (dzĭg′gĕ-tā), a wild ass found on the plateaus of Central Asia, which resembles the horse more than any other animal. The color is brown and a black stripe extends along the back. Naturalists regard this animal of the same family as the kiang and koulan. It is thought to be the "half ass" mentioned by Pliny and Herodotus.

E, the fifth letter and the second vowel of the English alphabet. It is used more frequently than any other of the 26 letters. Its natural or long sound is the same as *i* in the German, Italian, and French languages, as in *me, mere,* and *here.* The short sound of *e* is represented in words like *men, hen,* and *met,* while its sound equivalent to *a* is exemplified in *there.* Several modifications are recognized when long and short *e* are followed by *r,* as in *here* and *her;* and the *u* or *dropped sound,* as in *camel.* In pronouncing it the mouth is opened to a medium extent, the tongue is expanded to touch the upper molars, and the voice is gently expurgated. It is generally silent as a final letter, but serves to lengthen the preceding syllable, as in *plume, cane, mane,* though in some cases it exercises no influence on the preceding vowel, as in *give* and *gone.* The final *e* was pronounced in most cases up to the end of the 14th century, as is the case in Chaucer's "Canterbury Tales."

In music it is the third note of the diatonic scale of C. *E,* as a key in music, has four sharps in its signature, F, C, G, and D sharp; but minor E, as a key, has but one sharp, F. The abbreviation E. signifies East.

EADS (ēdz), **James Buchanan,** noted engineer, born in Lawrenceburg, Ind., May 23, 1820; died in the Bahama Islands, March 8, 1887. He settled at Saint Louis in 1833 and became a clerk on a steamboat six years later. In 1842 he designed a diving bell. Later he constructed several boats for raising large steamers, employing them in the Mississippi, and established the first glassworks west of the Mississippi River in 1845. When the Civil War commenced, he was called by President Lincoln to aid the national government, and constructed eight ironclads in about three months, these steamers being employed in the capture of Fort Henry. Later he built other ironclads and mortar boats. He commenced the construction of the steel-arch bridge across the Mississippi River at Saint Louis in 1867, at which he worked seven years. Subsequently he deepened the Southern Pass at the mouth of the Mississippi River by means of jetties, and planned the deepening of the river from its mouth to the mouth of the Ohio. Later he organized a company and engineered the building of a ship railway across the Isthmus of Tehuantepec, and was connected with other large enterprises. The British Society of Arts awarded him the Albert medal in 1884.

EAGLE (ē'g'l), the name by which many birds of prey are known. They are classed in the genus *Aquila* and the family *Falconidae,*

BALD EAGLE.

with which the eagles, falcons, and hawks are included. Eagles are regarded the most noble and courageous of the rapacious birds, and soar higher than any other birds of flight. The *golden eagle* has a dark, tawny-brown color, with a yellowish tinge on the back of the head and neck, and is a large and beautiful

bird. It attains a length of about three feet and is able to seize any kind of poultry, rabbits, and small quadrupeds and carry them to its nest in the rocky ledges and cliffs of mountains. This species is a common bird of many regions of Eurasia and North America. The *sea eagle* is found near the coasts of lakes and seas and feeds largely on fish and marine life. It has a grayish-brown color, white tail, and pale-colored head. The *bald eagle* is found in America and northern portions of Eurasia, and has been adopted as the symbol of the United States and some other countries. Its general diet is more extended than that of the *tree eagle,* and carrion is even taken in time of need. The *serpent eagle* is found in Southern Asia and Northern Africa, and in structure and habits approaches the buzzard. Other species include the *imperial eagle,* the *eagle hawk,* and the *crested eagle.* These birds are fond of fish and commonly feed on the dead fishes found along the shore. They are frequently seen in pursuit of the osprey and other birds, requiring them to drop the fish they may have caught.

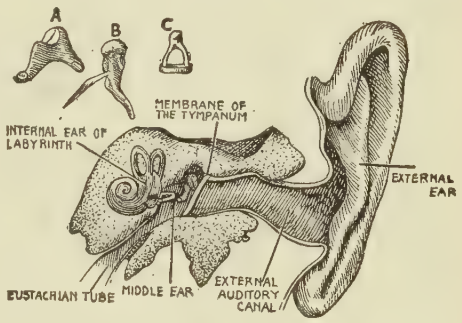
EAGLE, the bird most noted as a symbol of societies and nations. The Persians bore an eagle as a symbol upon a spear in battle as early as 401 B. C., and from them it passed as a war standard to the Egyptians. Among the Romans it was customary to use eagles of silver as a standard and rarely of gold, the custom being introduced among them in 104 B. C. The dynasty of Napoleon adopted the eagle as a symbol for France. A double-headed eagle was introduced as the emblem of Russia, and Charlemagne introduced it into Germany as a standard. The Russians have an association known as the White Eagle Order of Knighthood, and in the German Empire are Orders of the Black, Golden, and Red Eagles.

The Prussian Order of the Black Eagle was founded by the elector of Brandenburg in 1701, and is still maintained with a degree of marked respect. Its decoration consists of a Maltese cross surmounted by a royal crown. This cross is given for meritorious service by the emperor. The double-headed eagle is maintained as the standard of Austria. France long held the eagle in high esteem as a symbol, but it was abolished with the rise of the republic in 1870. The bald eagle is the emblem of the United States and is represented with outstretched wings, having the olive branch in one talon, a bunch of arrows in the other, and a shield upon its breast. Its head is surmounted by thirteen stars, while in its beak is a band bearing the inscription "E pluribus unum."

EAGLE, a gold coin current in the United States, equal in value to ten dollars. It was coined in 1795, weighing 270 grains and containing 247½ grains of pure gold. Later the government began to coin of the same fineness and of proportional value the double eagle, half eagle, and quarter eagle.

EAMES (āmz), **Emma,** soprano singer, born in Shanghai, China, Aug. 13, 1867. She descended from American parentage, her father being a lawyer in the international court of Shanghai, and spent her childhood in Boston, Mass., where she studied music. Later she received musical instruction in Paris, France, and made her début as *Juliette* at the Paris Grand Opera in 1889. Two years later she sang successfully in London and New York, and while in the former city married Julian Story, the portrait painter. Subsequently she appeared frequently in the larger cities of the world. Among her leading parts are the *Countess* in "Le Nozze di Figaro," *Colombe* in "Ascanio," and *Yasodhara* in "The Light of Asia." She studied and scored successes in the later rôles of Wagner in German.

EAR, the organ of hearing. It is divided into three parts: the external ear or concha, the middle ear or tympanum, and the internal ear or labyrinth. The *external ear* consists of a passage to the middle ear, is about an inch in length and a quarter of an inch in diameter,



EAR.

A, anvil; *B,* hammer; *C,* stirrup.

and is formed partly of flesh and partly of bone. Around its opening is a lobe, called the *auricle* or *pinna,* which serves to collect sound waves. Rudimentary muscles are connected with the external ear and are so well developed in some persons that they can move their ears as a rabbit or a horse does. The outer half of the passage is provided with a number of glands that secrete a kind of sticky wax, which prevents dust and insects from reaching the drum membrane. The gland secreting the wax grows outward towards the surface like the nails and prevents it from accumulating. Carelessness in picking the ear sometimes causes the wax to crowd against the drum membrane and results in partial or total deafness.

The *middle ear* is provided with a special mechanism for transmitting the air vibrations to the inner ear through two outer cavities. The tympanum or middle ear is connected by a small aperture with the inner ear. As to the size, the breadth of the middle ear is about a quarter of an inch and its length a half an

inch. It is lined with mucous membrane and filled with air. The drum membrane is a thin leaf which closes the outer end like a drum, and a similar membrane closes the aperture to the inner ear. The cavity of the middle ear is increased by extending backward into a bony projection, which can be felt behind the outer ear, and is called the *mastoid process.* From this a tube, called the *eustachian,* about the size of a knitting needle, passes to and connects with the pharynx, and is opened by the act of swallowing. A chain of three small bones, known as the *ossicles,* constitutes the essential part of the middle ear. These are called the *malleus* or *hammer,* the *incus* or *anvil,* and the *stapes* or *stirrup,* and extend across the cavity from one membrane to another.

When sound waves strike the ear drum. they are thrown into vibrations, which are transmitted to the inner ear by a chain of bones. The vibrations are increased by the tympanum and its extension into the mastoid cells, which act like the sounding box of a violin. The *internal ear* or *labyrinth* is the most delicate part. At its center it is about an eighth of an inch in diameter, this part being called the *vestibule.* A small spiral tunnel extends from the vestibule, which is called the *cochlea* from its resemblance to the inside of a snail's shell, and, besides it, there are three other tunnels called from their shape the *semicircular canals.* A clear liquid fills the labyrinth, which is lined with epithelial cells, and in them the nerves of hearing end. Cilia are numerous upon the surface of the epithelium, and among them are hard particles called the *ear sands.* When the sound waves reach the liquid, they produce waves that beat against the cilia, thus causing the sense of sound.

In order to produce a sound it is necessary that the waves in the liquid surrounding the nerves occur at least sixteen times a second. When they occur more than 38,000 times a second, no sound will be heard for the reason that they are too rapid for the nerves to take account of their action. The nerves of action may be excited by the air in the middle ear being too dense or too rare, by too much blood circulating in the middle ear, and by a blow upon the head or wax in the ear. Quinine and other drugs tend to produce abnormal excitement. In some cases an impression passes to the brain by the auditory nerve as though a real sound had excited the nerves. Other illusions are caused by an excitement of the pulse in an insane person. In dreams persons often get vivid impressions of sounds, and they are afterward recalled to memory and seem to be real.

Birds and quadrupeds have ears corresponding to those in man. No outer ear is found in turtles and frogs, but the drumhead forms a visible circle behind the eyes, just under the skin, and the middle ear contains a single bone. Snakes have no external or middle ear, but a bone extends from the inner ear to a kind of membrane immediately below the skin by which they are able to hear. The vibrations in fish are transmitted only through the skull, since they have no external or middle ear, and the labyrinth has no cochlea. Other animals have ears more or less modified, and those that have ears at all possess a modified form of the internal ear. See **Sound.**

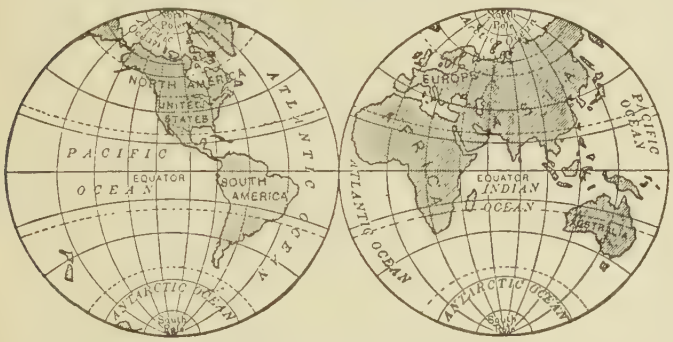
EARLY (ēr'lĭ), **Jubal Anderson,** general, born in Franklin County, Virginia, Nov. 3, 1816; died March 2, 1894. He graduated from West Point in 1837 and was appointed lieutenant of artillery, but resigned to study law. Subsequently he was elected to the Legislature of Virginia, but soon after enlisted for service in the Mexican War as major of a volunteer regiment. He served as colonel in the Confederate army at the beginning of the Civil War, and soon advanced to the rank of brigadier general. His service was distinguished at Fredericksburg and Gettysburg, but General Sheridan routed him at Cedar Creek and General Custer beat him at Waynesboro, after which he was relieved of his command. Subsequent to the war he traveled in Europe, and later resumed the practice of law at Richmond. He published "Memoirs of the Last Years of the War" and "Jackson's Campaign Against Pope."

EARRING (ēr'rĭng), an ornament suspended from the ear, the lower part of which is pierced for the purpose. Orientals have prized this mode of adorning the person from remote antiquity. Anciently earrings were worn by both sexes in many countries of Asia and Africa, especially in Persia, Egypt, Babylon, and Carthage. The fashion was confined to women in Greece and Rome, where the people looked upon this ornament as one especially fitted for those of rank. In the time of Queen Elizabeth it became fashionable to wear earrings by both sexes, and the custom still prevails to a considerable extent among men in some countries and among certain classes of laborers, especially sailors. However, earrings are worn chiefly in Europe at present, where the custom is quite general, but in America these ornaments are not used as extensively as in the past. Earrings are made chiefly of silver and gold, with settings of precious stones. All of the more valuable antique earrings are finely ornamented and contain settings of pearls. Many ornaments classed as earrings are not properly rings, but are attached to the ear with a hook, the size and value varying greatly according to changes in the fashion.

EARTH (ĕrth), one of the eight planets which revolve around the sun and from it receive light and heat. It is farther from the sun than Mercury and Venus, and is larger than Mercury, Venus, or Mars. A satellite, called *Moon,* revolves around it at an average distance, measured from the center of the moon, of about 239,000 miles.

Form and Size. Among ancient peoples the belief was current that the earth is an extensive flat surface surrounded by water, though many writers of antiquity suggested that its form is spherical, and some held the view that it revolves around the sun. Its spherical form is now admitted by the scholars of all civilized countries, and numerous proofs are submitted to establish that fact. The form is that of an oblate sphere, much like an orange, slightly flattened at two opposite sides and somewhat enlarged midway between. A diameter imagined drawn through the shorter distance is called the *axis,* the two ends of which are its *poles,* and a line drawn around it midway between the poles is the *Equator.* The length of the axis is 7,899 miles, and its equatorial diameter is 7,925.6 miles, or about 26.6 miles greater than the former. The *circumference* is 24,899 miles, and the entire surface is equal to about 197,000,000 square miles.

Proofs of Rotundity. Among the proofs that the world is round is the fact that men have circumnavigated it. Magellan was the first navigator to pave the way for this enterprise, in 1519. Though he was killed in the Philippine Islands two years later, the voyage was completed successfully by Sebastian del Cano, one of his officers. Sir Francis Drake successfully completed a trip round the earth in 1580, and since then many others have done likewise. The rotundity is also proven by the shape of the *great circle of illumination,* the line separating the portion of the earth's surface which is in the shadow from the part which is lighted by the sun's rays. Besides these are the facts that the horizon has a circular shape, that the earth's shadow cast on the moon during an eclipse of the moon is circular, that the tops of ships are seen first when sailing towards us and last when passing away, that the horizon of vision becomes larger as we ascend in a balloon or to an eminence, and that new constellations of stars appear as we pass from the Equator to the poles. The actual measurement of the arc of a meridian has not only demonstrated the earth's rotundity, but has enabled us to know approximately the amount of its oblateness.



HEMISPHERES, SHOWING PARALLELS AND MERIDIANS.

Surface Lines. We imagine the earth to be encircled by a number of curved lines, for the purpose of being able to locate places on its surface and to represent certain localities on globes and maps. They are divided into *great* and *small* circles, the former dividing the earth into two equal parts or hemispheres, and the latter dividing it into unequal parts. The Equator is a great circle, and divides the earth into the Northern Hemisphere and the Southern Hemisphere. Meridian circles are great circles that pass through the poles, while parallels are small circles that pass round the earth parallel to the Equator. Latitude is measured north and south of the Equator along the meridians by the parallels, and longitude is measured on the parallels, by the meridians, east and west of a prime meridian. Both latitude and longitude are reckoned in degrees.

Density. The density of the earth, that is, the quantity of matter it contains, is found by careful calculation to be 5,639 times that of water. This means that the real earth weighs 5,639 times as much as a sphere of water equal in size to the earth. The measurement of the earth's density was attempted about a century ago by calculating it from the attraction of a mountain on two plumb lines, one being suspended on each side. Since plumb lines suspended in this manner are attracted to the mountain mass, they indicate lines that converge toward the center of the earth, and by them geologists are able to compare the weight of the earth with that of the mountain, the latter having been first carefully examined and its weight calculated in tons. The mountain first utilized in making this important research is Schihallion in Scotland. Other methods include the test made by Cavendish, in which the attractive force of the earth was compared with that of two large balls over two other small balls by means of the torsion balance, that ascertained by the difference of oscillation of a pendulum when placed at the sea level and when at the top of a mountain, and the pendulum experiments at the top and bottom of a deep mine for determining the difference of gravity. There are other methods, but these are the principal ones and are regarded of greatest worth.

Creation. It is thought that the earth originally existed in a nebular or gaseous state, and that its elements and those of other heavenly bodies were generally distributed throughout space. By the expulsive force of heat, the attraction of gravity was overcome, and the different portions collected about nebulae that formed the centers of the various bodies. In

this way the earth took on its present form, the action covering long periods of time, perhaps many millions of years, each period represented in Genesis as days. The mass gradually cooled by radiation, the outer surface and the polar regions cooling first and forming a crust; while the interior, cooling by conduction, still retains a high temperature. The spherical form attests its former fluidity, while the highly crystalline state of rocks formed early and the warm climate during the geological past give evidence of great central heat during remote ages. That the interior is still highly heated is evidenced by a rise of temperature equal to 1° Fahr. for every 55 feet of descent into the crust. If this general rise in temperature continues, it reaches the boiling point at a depth of two miles, and at fifty miles below the surface the heat is sufficient to melt every solid.

Interior. As to the condition of the interior, various views have been expressed, among them that the earth has a solid crust and a solid center, with a heated pasty layer between; that the earth is solid throughout, but has a highly heated interior; and that the crust is solid, but the interior is a pasty mass in a highly heated condition. The last mentioned view is held most commonly and likely is correct, since the immense pressure at the center probably operates to raise greatly the melting point and tends to hold the mass in a pasty condition, even if the temperature is very high. The cooling effect of the heated interior causes the crust to contract or shrink, thereby crowding the materials into a smaller space, and exerting a marked influence on the crust. In some cases gases exert a marked pressure, rocks are melted, and frequently pressure is removed by certain portions of the earth's surface being elevated. In some cases water undoubtedly comes in contact with melted rocks by soaking down and is converted into steam. By this hypothesis it is possible to account largely for the phenomena of volcanic action, earthquakes, nonvolcanic igneous eruptions, and gradual elevations and subsidences of the crust.

Motion. The earth has two motions, the *diurnal* and the *annual*. The diurnal motion is its daily motion from west to east around its own axis, which requires twenty-three hours, fifty-six minutes, four seconds—about twenty-four hours—and is the direct cause of our common day and night. By annual motion is meant the revolution of the earth around the sun, which is completed in about 365 days and six hours, and is one of the causes of our common year. The orbit is in the form of an ellipse, and has a total length of about 577,000,000 miles. Since the sun is at one focus of the ellipse, the earth is nearer the sun at some times in its revolution than at others. The earth is at perihelion about the 1st of January each year, when it is about 3,000,000 miles nearer the sun than at aphelion, six months later. Its distance from the sun at perihelion is 89,897,000 miles and at aphelion, 92,963,000. The average velocity at which the earth moves in its orbit through space is about nineteen miles per second, while the rotation on its axis causes any point on the Equator to move about 1,042 miles per hour. However, the velocity caused by its rotation diminishes toward the poles.

The earth's axis is inclined 23½° to the plane of the ecliptic and points nearly to Polaris, the north star. Owing to this it is always approximately parallel to any former position, and different portions of the surface receive the vertical rays of the sun. From this it is clear that new portions of the surface are turned toward the sun every day during the revolution, thus causing the change of seasons. The winter solstice occurs on December 21 and the summer solstice on June 21. On the former date the days are shortest north of the Equator, while on the latter date the reverse is true. The vernal equinox occurs on March 20 and the autumnal equinox on September 22, at which two periods in each year the days and nights are of equal length in all parts of the earth. At the poles the longest days and nights are each six months, being caused by the constant parallelism of the earth's axis in its revolution. The Arctic Circle bounds the north polar zone and the Antarctic the south polar zone, each being 23½° from the pole, that being the distance the sun shines beyond the pole during the respective solstices, and include respectively the North and South Frigid zones. The sun shines directly on every point twice in the year throughout a region extending 23½° both north and south of the Equator, which is called the Torrid Zone. The circle in the Northern Hemisphere which bounds this region is called the Tropic of Cancer and in the Southern Hemisphere the Tropic of Capricorn, both being called tropics. Between the polar circles and the tropics are respectively the North and South Temperate zones, each occupying 43°.

Surface Phenomena. About 150,060,000 square miles of the surface of the earth are water and 46,940,000 square miles are land. The water surface is divided into five great oceans and numerous bays, seas, gulfs, and channels. Lakes, rivers, and glaciers are classed as features of the land surface, though the waters of most of them flow into the oceans. Tides, currents, and waves are great phenomena of the oceans, while earthquakes, rains, and winds equally affect both the water and the land surfaces. The Eastern Hemisphere contains the greater portion of the land masses, including all of Europe, Asia, Africa, and Australia, while the Western Hemisphere includes America. The only great land masses south of the Equator are Australia and portions of South America and Africa. Besides the five continents, there are numerous detached masses called islands.

These are known as continental, when near the continent; oceanic, when far out in the oceans; volcanic, when of volcanic origin; and coral, when built largely by the coral polyps. The greatest depths of the ocean are equal to the heights of the loftiest mountains, about 29,000 feet, and usually are found near the greatest land elevations. Land masses have irregular coast lines and a surface variously designated as valleys, plains, deserts, plateaus, mountains, and depressions below the sea level. The three kingdoms studied in relation to the earth are those of the minerals, plants, and animals. According to the latest reports, the total population is 1,500,000,000. See **Atmosphere.**

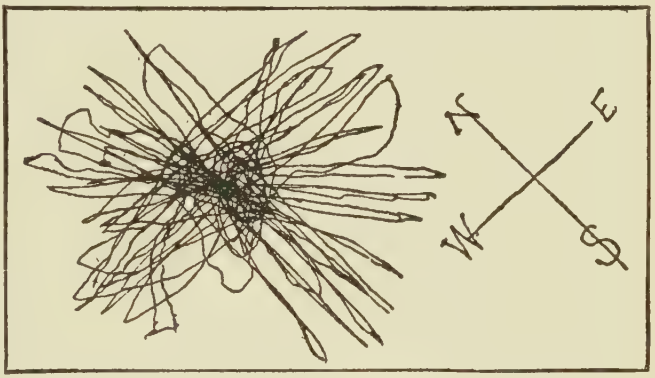
EARTH CURRENTS, the natural electrical disturbances which appear to be allied closely to the magnetic storms. They are associated with the magnetism of the earth. Though not well understood, they are known to be dependent upon or affected by the occurrence of spots on the sun and by the appearance both of aurora borealis and aurora australis. Communication by long lines of telephone or telegraph, and especially submarine connections, is affected constantly by earth currents.

EARTHENWARE, any object made of clay and dried in the sun or baked in a kiln, though the term is sometimes restricted to the inferior grades of earthenware as distinguished from stoneware and porcelain. See **Pottery.**

EARTHNUT, the name of the tubers of certain plants of the parsley family and a number of others, so called because they grow and mature in the ground. Pignut and earth chestnut are other names of plants of this kind. A species common to Sweden produces tubers which are valued for their nutriment and these form an important article of trade. Another species is common to Greece. Most of these tubers are about the size of a chestnut, have a brownish color and sweetish taste, and grow on slender roots from four to six inches below the surface. When used as an article of food, they are roasted or cooked in soups. Earthnuts are prized as feed for swine and are fed in some localities for fattening purposes.

EARTHQUAKE, a sudden undulation of a portion of the earth's surface produced by forces acting from beneath. Several theories have been advanced as to the probable cause of the disturbances, and, while any great concussion upon the surface of the earth may cause a diminutive earthquake, steam is clearly the most favorable agent, as its sudden generation or condensation on a large scale is sufficiently powerful to produce extensive movements in the earth's crust. Water probably finds its way through fissures in the earth's crust to heated rocks, where it is suddenly converted into steam. Some earthquakes are caused by the falling in of the roof of enormous subterranean caves formed by the solvent action of water on deposits of rock salt, limestone, or gypsum; by various gases that result from internal heat; and by the general contraction of the earth's crust, resulting from the radiation or conduction of heat. Earthquakes are classified according to the character of the movements, which may be *vertical, circular,* or *wavelike.* The circular or twisting movements are rare, but they are the most destructive.

There is little doubt that the cause of earthquake and volcanic action is the same, though the latter is governed materially by permanent channels through which the discharge is made. Certain premonitory symptoms usually herald the approach of a great earthquake, such as subterranean noises like cars running over a bridge. Suddenly the fatal moment arrives,



Record of the earthquake at San Francisco, Cal., in 1906, as recorded by the seismograph.

some portion of the surface becomes the center of impulse, and waves are propagated in all directions through the solid materials of the earth's crust. If the center of impulse is below the sea, as it often is, the vibrations of the ground are accompanied by inundations of water. The earth frequently heaves and swells like a rolling sea, fissures being produced in all directions similar to those on a broken windowpane, various noises accompanying the vibrations. These disturbances may consist of a single shock, lasting a few seconds, or a series of such shocks continuing for days or weeks. The principal shock at San Francisco, in 1906, had a duration of twenty-eight seconds. It was wavelike and the earth moved about two inches east and west and three inches north and south. Great changes in the surface of the earth have been made in a few seconds of time, as in the earthquake of Italy in 1908, and many towns and many thousands of lives have been lost. It is estimated that an earthquake occurs somewhere every day, though most of

them are barely perceptible. They are more numerous in winter than in summer and at night than during the day, for the reason that the cooling of the earth's crust is more rapid. They are more frequent when the attractive forces of the sun and moon act simultaneously, which occurs during full and new moons.

Some of the most destructive earthquakes on record are: 742 A. D., Asia, 500 towns destroyed; 1531, Lisbon, Portugal, 1,500 houses and 30,000 persons destroyed; 1693, Sicily, 54 towns, 300 villages and more than 100,000 lives lost; 1731, Pekin, China, 100,000 persons killed; 1754, Cairo, Egypt, 400,000 lives lost; 1755, Lisbon, Portugal, 50,000 persons killed. The most severe earthquakes ever known in the United States occurred at Charleston, S. C., in 1886, and at San Francisco, Cal., and its immediate vicinity on April 18, 1906. At the time of the latter a large part of San Francisco, many buildings of

MAP OF THE REGION DISTURBED BY THE EARTHQUAKE OF 1908.

the Leland Stanford Junior University, and much property in adjacent towns were destroyed. In the same year, on August 16, a destructive earthquake visited Valparaiso and other cities of Chile.

The most destructive earthquake of recent times visited Calabria and Sicily in December, 1908, when Messina and Reggio were almost totally destroyed. Suddenly and without warning, at 5:20 o'clock in the morning, the earth began to tremble. At Messina, after the city crumbled into ruin, a wave of water 35 feet high engulfed the streets at the water front. As the wave receded its surface was black with human corpses and the wreckage of houses. At Reggio a chasm eighty feet wide opened and belched out scalding water. The disturbance extended from the vicinity of Naples to some distance south of Catania, but it was centered largely in the Strait of Messina, between Messina and Reggio. The earthquake of Japan, in 1923, destroyed property valued at $935,500,000. The loss of human life was about 200,000.

EARTHS, in chemistry, a class of substances consisting of a metal combined with oxygen, erroneously regarded elementary by alchemists and early chemists. They are insoluble, inodorous, and tasteless, and constitute the larger part of the soil and gravel. Lavoisier classed them as compounds and they are so recognized in modern chemistry. The list includes baryta, lime, strontia, and magnesia, which are classed as alkaline earths, since they are less soluble in water than true alkalies. Thoria, zirconia, alumina, didymia, glucina, erbia, ceria, yttria, and lanthana are true earths.

EARTH SHINE, the faint light seen on the part of the moon not illuminated by the sun, but which is cast upon her by the earth. Sometimes the outlines of the full moon are made visible by the reflection, which occurs on clear nights at the time the moon is very old or very new.

EARTHWORM, or **Angleworm**, the common name of many species of worms found widely distributed in the tropical and temperate regions. They are called earthworms because they burrow in the earth, but are known in some sections as angleworms or fishworms, since they are used as bait in angling. After a hard rain they are seen on the surface, when they are said to have *rained down*, but their coming out of the ground is due to the fact that they crawl about in attempting to get away from the water. The body is formed of many narrow rings in contact with each other, and is covered with rows of bristles pointing backward. It has no tentacles, eyes, ears, or teeth. The upper lip is extended, forming a kind of proboscis. Those commonly seen in the Temperate zones are three or four inches long, though some, when fully extended, are nearly a foot in length. They swallow the decaying parts of animals and vegetables and take with them into the ground a quantity of soil, which is subsequently ejected in small heaps called *worm casts*. It is estimated that on an acre ten tons of earth is thus improved and enriched

EARTHWORM.

every year. The passages they burrow in passing through the soil loosen and stir it, making room for roots to grow more easily, and for the elements of the air to destroy the poisonous alkalies. Charles Darwin expressed the view that vegetable soil in its present aspect and distribution was produced largely by earthworms. Besides their usefulness in the improvement of the soil, they are important as food for birds, fishes, and insects.

EAR TRUMPET, an instrument used by those who have defective hearing or are partially deaf. Many forms of this contrivance are in general use, but they agree in having a trumpet-shaped tube to collect and condense the sound waves, and thus intensify the impression upon the ear. The ear trumpet is held by the hand in the direction where the sound originates, while the other end of the tube is placed in the cavity of the ear. It is not necessary to have an expensive adjustment of the parts, since sound is readily reflected along conical tubes, whether they are straight or coiled. Small ear trumpets, called cornets, are attached to the ear by a spring, hence are concealed by the hair of the wearer, but these can be used to an advantage only where the hearing is very slightly impaired.

EARWIG (ēr'wĭg), a genus of insects allied to the cockroach and classed with the runners. They have six feet well formed for running; two pairs of wings, an upper short pair and a lower gauzelike pair; a mouth formed for mastication; and a somewhat flattened body. The

Earwigs, showing larvae and perfect insects.

abdomen has strong pinchers and the head is provided with delicate antennae. The earwig is so named from the erroneous belief that it creeps into the ears of sleepers. Several species are widely distributed in Europe. In North America these insects are found only on the Pacific Coast and in the central and southern parts of the continent. Several small centipedes which frequent houses in the United States are known as earwigs.

EASEMENT, in law, the right which one person has in the real estate of another, not inconsistent with the general property of the owner, such as a right of way over it or a right to lay pipes below the surface It is distinguished from a mere license, since an easement is a permanent right. An easement is called a *dominant right*, while the land burdened is termed the *servient estate*. It is acquired either by *grant* or by *prescription*. The former is usually by a formal written deed, but an oral grant is sufficient when the possession passes to the grantee.

EAST AURORA (ą-rō'rą), a village of New York, in Erie County, seventeen miles southeast of Buffalo, on surfaced highways and the Pennsylvania Railroad. It is surrounded by a fertile farming country, and contains the residences of many Buffalo business men. Among the facilities are electric lights, public waterworks, and a number of fine school buildings. Aurora is noted as the seat of the Roycrofts, a printshop which produces fine editions of standard and current books and handmade furniture. Population, 1920, 3,703.

EASTBOURNE (ēst'bûrn), a seaside resort of England, in Sussexshire, on the coast between Brighton and Hastings. It has railroad facilities, electric lights, finely paved streets, and a commodious town hall. Along the shore is a fine drive two miles long. It has gained rapidly in population on account of its healthful situation and popularity as a coast resort. The town was incorporated in 1883. Population, 1921, 52,544.

EAST CAPE, the most easterly cape of Asia, extending into Bering Strait, nearly opposite Cape Prince of Wales, the most westerly point of North America. It is a rocky promontory and is almost cut off from the mainland by shallow lakes and swamps. The village of Uedle is situated on the northeastern side, containing a population of 300. The name Cape East is also applied to the southeastern extremity of New Guinea; the eastern headlands of North Island, New Zealand; and the easternmost point of the island of Madagascar.

EAST CHICAGO, a city of Lake County, Indiana, 20 miles south of Chicago, on the Wabash, the Pennsylvania, and other railways. It is important as an industrial center, having extensive manufactures of iron and steel locomotives, railway cars, ironware, and machinery. The chief buildings include the city hall, high school, Carnegie library, and many churches. It has street railways. Population, 1920, 35,967.

EASTER (ēs'tẽr), the festival kept in commemoration of the resurrection of Christ. It was observed by the early Christians as a continuation of the feast of the passover and generally lasted eight days, from Palm Sunday to Easter Sunday inclusive. It was a time of joy. The austerities of Lent were over; alms were given to the poor and needy; sports, dances, and farcical exhibitions were indulged; and stories and legends were recited by the clergy to stir the hearts of the hearers to laughter. On Easter day the people saluted each other with a kiss and the exclamation, "He is risen;" to this the reply was, "He is risen, indeed." A long controversy took place between

the Eastern and Western churches as to the proper time for celebrating Easter, but in 325 it was fixed by the Council of Nice on the first Sunday after the full moon occurring upon or next after March 21. Easter, the feast of eggs, is considered emblematical of the resurrection and of a future life.

EASTERN QUESTION, the problem which relates to Turkey in Europe and the occupation of the Balkan Peninsula. It has been a complicated issue of international politics for many years, but its modern phase dates from 1856, when the Congress of Paris made definite declarations upon the questions involved in the Crimean War. The war between Russia and Turkey in 1877 opened the problem anew, after which the Congress of Berlin refused to permit the former country to receive the full benefits arising from the new status created by the conflict. It was likewise influenced by the annexation of Eastern Rumelia to Bulgaria in 1885, the war between Greece and Turkey in 1897, and the establishment of autonomy in Crete. The question was again opened in 1908, when Bulgaria declared its independence and Austria-Hungary proclaimed the annexation of Bosnia and Herzegovina. It is not probable that the issues will be finally adjusted until the territory of Turkey in Europe becomes absorbed by the nations of Europe, when the status existing at the time of the ancient Byzantine Empire will be restored in a measure and the Turks will be confined beyond the Hellespont.

EASTERN RUMELIA. See **Rumelia.**

EASTHAMPTON (ēst-hămp′tŭn), a town of Massachusetts, in Hampshire County, four miles southwest of Northampton. It is on the Boston and Maine and the New York, New Haven and Hartford railroads, and has a growing trade in merchandise and produce. The manufactures include yarn, rubber goods, cotton textiles, worsteds, and machinery. It is the seat of Williston Seminary, a preparatory school for boys, and has a fine public library. Waterworks, electric lights, and several fine schools are among the public improvements. The settlement of Easthampton dates from 1665, and it was organized as a town in 1809. Population, 1905, 6,808; in 1925, 11,587.

EAST HARTFORD a town of Connecticut, in Hartford County, a short distance east of Hartford, on the New York, New Haven and Hartford Railroad. It has railroad shops and manufactures of paper, tobacco, clothing, and machinery. The noteworthy buildings include a town library, the Raymond Library, and the high school. It has public waterworks and electric lighting. The first settlement on its site was made about 1645. Population, 1920, 8,218.

EAST INDIA COMPANIES, the term used to designate companies organized in the 17th and 18th centuries for the planting of colonies and the promotion of trade. They were organized under the governments of Holland, Great Britain, Sweden, and Denmark, and were given a monopoly of foreign and colonial trade within certain districts. The company operating in a specified region was granted exclusive control in the matter of government and was permitted to organize armed forces, equip natives, and build defenses for the general good. Some of the companies paid an annual tax to the home government and in return received aid and protection. After a time difficulties arose regarding territorial claims, which resulted in several wars between some countries of Europe. The first English company was granted a charter by Queen Elizabeth in 1600 for the purpose of securing East Indian trade. It was chartered as "The Governor and Company of London Merchants Trading with the East Indies." It became the most powerful body in its time, represented a large capital, and was controlled by a court of proprietors, who were large shareholders in the company. Parliament appointed a government board of control in 1784, and in 1858 made India a crown province, when the company ceased active existence, though for several years afterward it maintained an organization for the purpose of closing up its business.

In 1602 the Dutch company was organized and vied with the British until 1795 for the supremacy of the East Indian seas. The Danish company was founded in 1618 and had a varied existence until 1729, when its property interests were transferred to the state. In 1664 the first French company was founded. It continued operations until 1769, when its business interests were merged into the government. The Swedish company organized for the Indian trade in 1741, and reorganized on a government basis in 1806. Both the Danish and French made their chief seat of operations on the Coromandel Coast, while the Dutch operated in Sumatra, Java, and adjacent islands, and their possessions in the Dutch East Indies date from the operation of their company. The British company settled largely in India proper, at Calcutta, in Bombay, Bengal, and Madras.

EAST INDIES (ĭn′dĭz), the name applied to the region which includes the two great peninsulas of Southern Asia and the islands located from the delta of the Indus to the northern extremity of the Philippines. The appellation is made usually to distinguish these islands from the West Indies, and quite frequently includes all the islands southeast of Asia, except the Philippines and New Guinea.

EASTLAKE (ēst′lāk), **Sir Charles Locke,** historical painter, born in Plymouth, England, Nov. 17, 1793; died in Pisa, Italy, Dec. 23, 1865. He first attended the Charterhouse School, London, and later studied at the Royal Academy and in Paris. He was compelled to leave France at the time Napoleon returned from Elba, after which he resided for a time in his

native town and later at Rome, where he produced many of his paintings. His best known paintings include "Christ Weeping over Jerusalem," "Hagar and Ishmael," and "Beatrice." Eastlake attained a high reputation as a writer on art. Among his productions are "Penny Cyclopedia," "Materials for the History of Oil Paintings," and a translation of Goethe's "Farbenlähre." His wife, Lady Elizabeth Eastlake (1809-1893), distinguished herself as an authoress by contributions to the *Quarterly Review.*

EAST LIVERPOOL (lĭv'ĕr-pōōl), a city of Ohio, in Columbiana County, on the Ohio River. It is on the Cleveland and Pittsburg Railroad and is surrounded by a fertile country. The noteworthy buildings include the public library, the high school, the city hall, and several fine churches. Many of the streets are substantially paved, lighted by gas and electricity, and traversed by electric street railways. The manufactures embrace furniture, cigars, machinery, ironware, and farming implements. It has large pottery interests and extensive machine shops. The place was settled in 1795 and incorporated in 1834. Population, 1920, 21,411.

EASTMAN, Elaine Goodale, poetess, born in Mount Washington, Mass., Oct. 9, 1863. In connection with her sister, Dora Reed Goodale, she published "Verses from Sky Farm," "Apple Blossoms," "In Berkshire with the Wild Flowers," and "Verses of Two Children." She became a teacher of the Indians at the Hampton Indian Institute, and subsequently at the White River Camp school, in South Dakota. In 1891 she married Dr. C. A. Eastman, a full-blooded Sioux Indian. Her chief work is "Journal of a Farmer's Daughter."

EASTMAN, George, business man, born near Rochester, New York, July 12, 1854. In 1888 he perfected the first kodak, and soon after organized the Eastman Kodak Company, one of the largest concerns in the world. Being a friend to education, he made many gifts to institutes of various kinds.

EASTON (ēst'ŭn), a city of Pennsylvania, county seat of Northampton County, 52 miles north of Philadelphia. It is at the junction of the Delaware and Lehigh rivers and on the Pennsylvania, the Lackawanna, the Central of New Jersey, and other railroads. Extensive slate quarries and coal and iron fields are worked in the vicinity. Bridges connect it with South Easton and with Philipsburg in New Jersey. The noteworthy buildings include the public library, the county courthouse, and the high school. It is the seat of Lafayette College, a Presbyterian institution established in 1832.

Easton is an industrial center and a shipping point for coal and produce. The manufactures include machinery, wire, clothing, hardware, cordage, musical instruments, and food products. It has street railways, gas and electric lighting, waterworks, and pavements of stone and macadam. The place was laid out in 1750 and incorporated in 1789. Important treaties with the Iroquois were made here in 1756 and 1761. Population, 1900, 25,238; in 1920, 33,813.

EAST ORANGE, a city adjacent to Newark, N. J., twelve miles west of New York City, on the Lackawanna and the Erie railroads. Many business men of New York have handsome villas and make it their residence. The chief buildings include the public library, the town hall, and many schools and churches. It has electric lighting, well-paved streets, systems of sewerage and waterworks, and electric railways. It was a part of Orange until 1863 and was incorporated as a city in 1890. Population, 1905, 25,175; in 1920, 50,587.

EASTPORT, a city and port of entry in Maine, in Washington County, the easternmost settlement of the United States. It is located on Moose Island, in Passamaquoddy Bay, and has a deep harbor. The chief industries are fishing, shipbuilding, and sardine canning. Among the principal buildings are the public library, a customhouse, and several schools. The first settlement was made at Eastport in 1782, but it was claimed by England and captured in 1814. The British governed it under martial law until June 30, 1818. Population, 1900, 5,311; in 1920, 4,494.

EAST PROVIDENCE, a town of Rhode Island, in Providence County, across the Seekonk River from the city of Providence, on the New York, New Haven and Hartford Railroad. It is important as a manufacturing and commercial center. The chief manufactures include chemicals, fencing wire, handkerchiefs, clothing, and machinery. It was formerly a part of the town of Rehoboth together with Seekonk, Mass., but was set off from the former when the boundary line between Rhode Island and Massachusetts was definitely fixed. It was incorporated in 1862. Population, 1905, 13,750; in 1925, 26,088.

EAST RIVER, the name applied to the strait between Long Island Sound and New York Bay. It is twenty miles long and separates the boroughs of Brooklyn and Queens on the southeast from those of the Bronx and Manhattan on the west and north. Blackwell's, Riker's, and Randall's are among the islands within the strait. It is spanned by the Brooklyn, the Williamsburg, and other great bridges. At the center of its course the Hellgate rock formerly obstructed the passage, but it has been removed by blasting. The strait is not properly a river. The misnomer probably arose from the powerful action of the tides, which resemble the current of a river.

EAST SAINT LOUIS, a city of Saint Clair County, Illinois, on the Mississippi River, opposite Saint Louis, Mo., with which it is connected by the famous Eads's Bridge. About twenty railroads enter the city, including the Illinois Central, the Wabash, the Baltimore and Ohio, the Chicago and Alton, and other lines. Among

the noteworthy buildings are the public library, the city hall, the Howe Literary Institute, a Roman Catholic academy, and the public high school. Among the industries are rolling mills, car shops, gas works, foundries, nail factories, brickyards, machine shops, flouring mills, and glass works. It has one of the largest stockyards in the United States and has extensive interests in beef and pork packing. The streets are well paved, drained, and lighted. It was incorporated as a town in 1861 and as a city in 1865. A tornado swept over the city in 1896, killing about 500 people and destroying property valued at $10,000,000. Population, 1920, 66,740.

EATON (ē'tŭn), **Dorman Bridgman,** lawyer and civil service commissioner, born in Hardwick, Vt., June 22, 1823; died Dec. 23, 1899. He graduated from the University of Vermont and the Harvard Law School, after which he was admitted to the bar of New York, forming a law partnership with the late George Kent. After traveling abroad for some time in pursuit of information in civil service, President Grant appointed him a member of the first national civil service commission. He again visited Europe in 1877 at the request of President Hayes, and made a report to Congress regarding civil service in several countries. His influence as a civil service reformer was highly effectual in the administrations of Presidents Arthur and Cleveland. He drafted a law establishing the police courts of New York City in 1866, and in 1875 prepared a code of laws for the District of Columbia. By his will a fund of $100,000 was given to Harvard and Columbia universities. Among his publications are "Civil Service in Great Britain," "Independent Movement in New York," and numerous magazine articles.

EATON, John, educator, born in Sutton, N. H., Dec. 5, 1829; died Feb. 9, 1906. He attended Dartmouth College, after which he studied in Andover Theological Seminary, and in 1861 was made chaplain in the Federal army. He was appointed superintendent of contrabands in 1862, and before the close of the war was brevetted brigadier general of volunteers. Subsequently he was a commissioner of the Freedman's Bureau, edited the *Memphis Post* in 1866-67, and the latter year was elected State superintendent of schools in Tennessee. He became commissioner of education of the United States in 1871, serving efficiently until 1886, in which year he was chosen president of Marietta College, Ohio. This position he held until 1891, and in 1895 was chosen president of Sheldon Jackson College of Salt Lake City. He was appointed inspector of education for Porto Rico in 1898. Among his publications are a number of excellent addresses and pamphlets relating to education. His books include "The Mormons of To-day," "The Freedmen in War," and "The History of Thetford Academy."

EATON, Margaret O'Neill, best known as Peggy O'Neill, the wife of J. H. Eaton, born in 1796; died in Washington, D. C., Nov. 8, 1879. She was the daughter of William O'Neill, an Irish hotel keeper of Washington, and after the death of her first husband, John B. Timberlake, she married J. H. Eaton, Secretary of War under President Jackson. When her husband was appointed to a position in the Cabinet, she attained to a social position that she had long desired, but reports of her questionable conduct in her previous life caused the other members of the Cabinet to refuse to recognize her on equal terms with their families. This caused an extended feud in the society of Washington and President Jackson reorganized his Cabinet to overcome disagreeable opposition. This circumstance caused Jackson and Van Buren to become very warm personal friends, but the friendship between Calhoun and the President was alienated, and through it Van Buren received the Democratic nomination for President in 1836, which would otherwise likely have been given to Calhoun.

EAU CLAIRE (ō klâr'), a city of Wisconsin, county seat of Eau Claire County, on the Chippewa River, at the mouth of the Eau Claire River. It has commercial waterpower and is on the Minneapolis, St. Paul and Sault Ste. Marie, the Chicago and Northwestern and the Chicago, Milwaukee and Saint Paul railroads. The site of the city is divided into three parts by the two rivers, which are crossed by several bridges. It is the center of an extensive market in lumber and produce. The chief buildings include the county courthouse, the high school, the public library, and the Federal building. It is the seat of several institutions, including the Lutheran and Sacred Heart hospitals. Among the products are flour, machinery, paper, hardware, lumber, and woolen goods. Gas and electric lighting, pavements, sewerage, and waterworks are among the improvements. An abundance of water power for manufacturing is obtained from both rivers. Population, 1905, 18,737; in 1920, 20,880.

EBERS, (ā'bērs), **Georg Moritz,** eminent Egyptologist and writer, born in Berlin, Germany, March 1, 1837; died Aug. 7, 1898. After graduating at Göttingen and Berlin, he taught at Jena, and in 1868 became professor of Egyptology at Leipzig. By making several journeys through various parts of Asia and Africa, he added much of value to the fund of knowledge in archaeology and philology.

GEORG M. EBERS.

In 1873 he discovered a scroll dating from the 2d century B. C., near Thebes, now called the *Papyrus Ebers*. It is preserved in the University of Leipzig. Among his best known writings are "Egypt and the Books of Moses," "Through Goshen to Sinai," "In the Blue Pike," "Story of My Life," "Cleopatra," "The Coptic Art," "The Sisters," and "An Egyptian Princess."

EBERT, Frederich, president of Germany, born at Heidelberg in 1871. His father was a tailor and the son became a harness maker. In 1900 he was chosen as a socialist to the city council of Bremen, whence he was elected to the national *reichstag*. He supported the government in the war in 1914, but opposed the plan of annexing territory. In 1918, following the revolution, he was chosen temporary president and was elected for a term of seven years in 1919. His administration was a potent force in reconstruction after the war. He died Feb. 28, 1925.

EBNER-ESCHENBACH (āb'nēr-ĕsh'enbäg), **Marie,** novelist and poet, born at Castle Zdislawitz, Austria, in 1830. She was a countess by birth and married an Austrian officer. Her writings included "Without Faith," "Lotti, the Watch Maker," "The Harmful," "Village and Castle Histories," "Bertram Wogelweid," and "The Old School."

EBONY (ĕb'ŭn-ĭ), a hard, heavy wood, usually dark, susceptible of a high polish, and used in many kinds of ornamental cabinet work. In various species of trees the heartwood becomes black and is the ebony of commerce. The Ceylon ebony is, perhaps, the best known, although the West India or Jamaica ebony of the bean family, a greenish-brown product, and the green ebony of the spurge family are of importance commercially. On account of jet black ebony being free from veins, it is considered the best. The different species are variously used for toys, mosaics, veneering, and inlaid work.

ÉCARTÉ (ā-kär-tā'), a game of cards which is popular in France, played ordinarily by two persons, but *pool écarté* may be played by three or more. In the latter the third player and others in the game act as advisers, remaining close at hand and advising one of the players, and, when one player loses a game, his place is taken by the adviser. The object is for the player to get all the tricks, but it is necessary for him to follow suit, if possible.

ECBATANA (ĕk-băt'a-nà), an ancient capital of Media, founded about 728 B. C. It was inclosed by seven concentric walls, the innermost of which was gilded and the next was plated with silver, while the others were painted in order orange, blue, scarlet, black, and white, respectively. They rose in graduation toward the center, hence could all be seen at once by a spectator occupying an advantageous point. On a conical hill stood the beautiful temple of the sun. The city was about thirty miles in circumference during its prosperity. It was captured by Cyrus in 549 B. C. and later by Darius, who found there the edict of Cyrus the Great concerning the rebuilding of the temple of Jerusalem. Alexander the Great conquered it while on his famous Asiatic expedition. On account of its beautiful surroundings and mild climate it was made the summer residence of first the Median, second the Persian, and lastly the Parthian monarchs. It was pillaged by the Seleucidae and later by Antiochus the Great, and fell into utter decay, so that its exact site can no longer be fixed with certainty, though historians generally agree that the present Hamadan, containing the supposed tombs of Mordecai and Esther, occupies its ancient site.

ECCENTRIC (ĕk-sĕn'trĭk), a contrivance in mechanics for securing reciprocating rectilinear motion from a revolving shaft. It consists of a disc fixed on the axis or center of a wheel, which does not pass through the center of the other disc. Not being in the center, the result of its revolution is the same as a crank. It is used chiefly in machinery where a subsidiary motion of small power is required, as in operating the slide valves of steam engines and in working the force pumps of steam boilers.

ECCLESIA (ĕk-klē'zĭ-à), a popular assembly of the people, especially of Athens, to discuss public affairs. According to the laws of Solon these assemblages were held four times every 35 days, unless special meetings were called, when messengers were sent to summon the people from the country. Every citizen twenty years of age could vote and was required to attend under penalty of a fine. The poorer classes were paid a small sum for attendance. The meeting usually began by prayer to the gods, after which the business was introduced. Any regularly convened assembly came to be called *ecclesia,* and the name was afterward applied to the Church by the New Testament writers.

ECCLESIASTES, one of the canonical books of the Old Testament, commonly called the *Preacher* in the English versions. In the Hebrew it is called *Kohelcth,* meaning the gatherer of the people. It is generally ascribed to the authorship of Solomon, but modern criticism places it at a much later date. The vanity of earthly good and the certainty of judgment are the two leading ideas of the Preacher. Some writers have imputed an epicurean meaning to several passages, but others regard them as mere ironical expressions.

ECCLESIASTICUS (ĕk-klē-zĭ-ăs'tĭ-kŭs), a book of the Apocrypha, commonly called the *Wisdom of Jesus the Son of Sirach.* The Jews and Protestants accept it as an apocryphal writing, but the Roman and Greek churches class it as canonical. It is recommended to be read for edification by the Articles of the Anglican Church. This book appears to have been written in Hebrew at Jerusalem about 250 B. C. It contains rules rather than principles for living, admonishes man to honor the law, and approves

of the righteous life for the happiness that it brings.

ECHIDNA (ĕ-kĭd'nȧ), a genus of toothless mammals native to Australia. These animals have a long, slender muzzle, toothless jaws, long, thick fur intermingled with sharp spines, and feet provided with powerful claws. When frightened or in danger, they curl up like the hedgehog to protect the under parts, which have no spines. They are closely allied to the duckbill and, like it, propagate by eggs. The food consists chiefly of ants and other insects, for which they burrow in the earth. The body is from a foot to eighteen inches long and somewhat broad and depressed, and the movement is quite rapid, considering the shortness of the legs. They lie dormant during the seasons of drought and come out most frequently at night. Their flesh is prized as food by the Papuans and other natives.

ECHINODERMATA (ĕ-kī-nŏ-dĕr'mȧ-tȧ), one of the grand divisions into which the animal kingdom is divided. It constitutes an independent assemblage of organisms, formerly classed as radiates with the Coelenterates, and ranks as the third from the lowest of the divisions of the animal kingdom. The five parts of their body radiate from a central axis, hence the former classification, and their external skeleton is calcareous, which is leathery in some species and in others is covered with spines. The alimentary canal is distinct from the body cavity and is protected by the skeleton, and the nervous system is radiate. Reproduction is by eggs. The young are greatly different from the adult, especially in that they are bilaterally symmetrical, instead of having the radiate structure.

Some species of the Echinodermata effect locomotion by a peculiar water vascular system, by which the water is carried to a system of locomotor tube feet, or *ambulacra,* these being thrust outward and forward to produce movement. In some of the larvae movement is effected by long arms, which are stiffened by slender rods of carbonate of lime. These arms are absorbed at the time metamorphosis takes place. The sense of touch is well developed, but only traces of pigment eyes and of the blood system are found in some of the species, while in others they appear to be entirely absent. All the species, of which there are about 3,000 now living, are marine and are distributed through all seasons. Seven divisions have been made of the echinodermata, depending upon the form of the body. They include the sea cucumbers, sea urchins, brittle stars, starfishes, cystoids, and pentremites. See **Starfish; Urchin.**

ECHO (ĕk'ō), in Greek mythology, one of the Oreades or mountain nymphs, daughter of the earth and air. It is related that Echo fell in love with Narcissus, who was deaf to her entreaties. In her grief she wasted away until nothing remained but her bones and her voice. Later she was avenged by Nemesis, who inspired Narcissus with a love for himself. Many poets have used the story as a basis for exquisite productions.

ECHO, a Greek word meaning sound, signifying the repetition of a sound wave, in the air, reflected from some obstacle. When the reflecting surface is at right angles, the sound waves are returned to the person or object causing them, but, if oblique, the echo is sent in another direction and may be perceived in some other locality than the one from which the waves were induced. No absolute law can be laid down for the exact distance the reflecting object must be from the speaker. Sound at 60° Fahr. has a velocity of 1,120 feet per second. If in ordinary speech five syllables are uttered in a second, then the speaker, standing in front of a reflecting surface 112 feet distant, can hear the last syllable. The other syllables are reflected, but reach the speaker just as he begins the next syllable, hence he does not hear them as distinct sounds. A sharp, quick sound may be heard 56 feet distant. In a properly constructed hall the voice of the speaker is strengthened in effect by the waves reflected by the walls and ceiling. If the walls are too close or too far the sound is confusing. Natural echoes are produced by woods, hills, rocks, and mountains, and many localities have become famous on account of them. Some echoes are repeated a number of times. It is said that the report of a pistol is repeated sixty times by an echo in the Simonetta Palace, near Milan, Italy. Lake Killarney, in Ireland, is noted for its echo, which belongs to this class.

ECK, Johann Maier von, celebrated theologian, born in Swabia, Germany, Nov. 13, 1486; died Feb. 10, 1543. At the early age of eleven years he entered the University of Heidelberg, and later took a course at Tübingen, where he obtained a degree in his fourteenth year. He studied jurisprudence and mathematics in Freiburg and in 1506 published a work on logic. In 1518 he privately circulated his "Obelisci" against Luther's thesis on the mass. Carlstadt answered the insinuations of Eck in 400 distinct theses, declaring his readiness to meet him in public disputation. The challenge was accepted and the general impression was that victory rested with Eck, after a three weeks' discussion with both Carlstadt and Luther, but temporary success only embittered his animosity against his opponents, and he used his whole ingenuity to overthrow Luther. He named his opponents Lutherans. In 1520 he returned from Rome with the papal bull of condemnation, but met with such an unfavorable reception by the people of Leipzig that he sought refuge in the Saint Paul convent. He took a leading part in the Augsburg Diet in 1530, the conference at Worms in 1540, and that at Ratisbon in 1541, laboring in vain to unite the divided church.

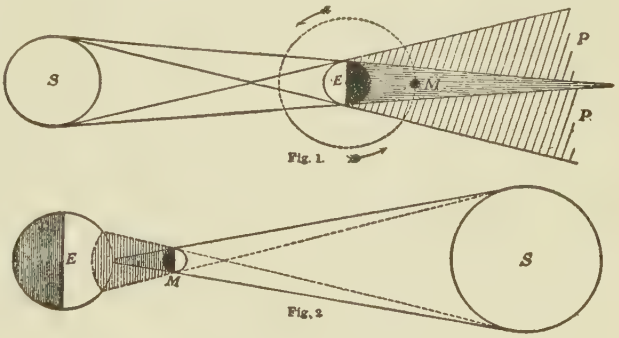
ECKFORD (ĕk'fērd), **Henry** naval archi-

tect, born in Irvine, Scotland, March 12, 1775; died Nov. 12, 1832. He came to Canada at an early age and worked in the shipyards of his uncle, John Black, at Quebec, but removed to New York in 1796, where he established a shipyard of his own. In 1812 he received a large order from the United States to construct vessels of war for the lakes and inland waters, and during the war with England completed many ships and boats for the government. He built the steamer *Robert Fulton,* which was purchased by Brazil, and in 1820 took charge of the navy yard at Brooklyn, where he superintended the construction of six ships of war. In 1831 he went to Constantinople with a frigate constructed for Turkey, and engaged as naval constructor for the government of that country, but died before the work became established.

ECLECTICS, a class of philosophers who selected or chose from others what they considered the best parts of all the recognized systems. As a school of philosophy eclecticism necessarily had its rise after other systems had been established, since it chose what was regarded the best and harmonized it into a new system. Since both Plato and Aristotle drew from the philosophies of those who preceded them, they may be regarded as eclectics in a certain sense. However, those belonging more particularly to this class include Plutarch, Plotinus, and Epictetus. Victor Cousin, the French writer on the history of philosophy, is the most eminent modern eclectic.

ECLECTIC SCHOOL OF MEDICINE, the school of medicine which relies upon treating patients as thought advisable by the physician rather than to follow closely the instruction of schools. It is an American system and is known also as the New School of Medicine, though it may more properly be said to be the modern representative of a system of healing that dates from the year 200 B. C. It must not be assumed that the eclectic practitioner is an absolute individual, but rather that he relies upon individual judgment while at the same time he keeps in mind what has been learned in medicine and the art of healing by experiments. Wooster Beach founded an eclectic college in New York City in 1826, and it may be said that the modern eclectic school of medicine dates from the early part of the 19th century. He published a number of text-books which are still looked upon as standard, and founded colleges in a number of states. In 1870 the National Eclectic Medical Association was incorporated in New York and since then other associations of the same kind have been organized, all of which have for their aim the improvement in the art of healing. While the medicines generally employed in the treatment of diseases are used by this school, in theory it does not favor the employment of mineral substances and is an advocate of using native plants that possess medicinal properties. This position in relation to plants has been the means of obtaining much information regarding American plants useful in the treatment of diseases. In 1922 there were about 875 students in attendance at 22 eclectic medical colleges in the United States.

ECLIPSE (ē-klĭps′), an obscuration, partial or total, of a heavenly body by its entering the shadow of another body, as when the moon enters the shadow of the earth, or a satellite that of a planet. An eclipse may occur by the partial or total disappearance of the sun as the effect of the passage of the moon between it and an observer. Stars, planets, and the satellites of planets may be eclipsed, but the principal eclipses are those of the sun and moon. An eclipse of the sun begins by an obscuration of the western side of the disc and ends on the eastern, while an eclipse of the moon begins on the eastern and ends on the western side.

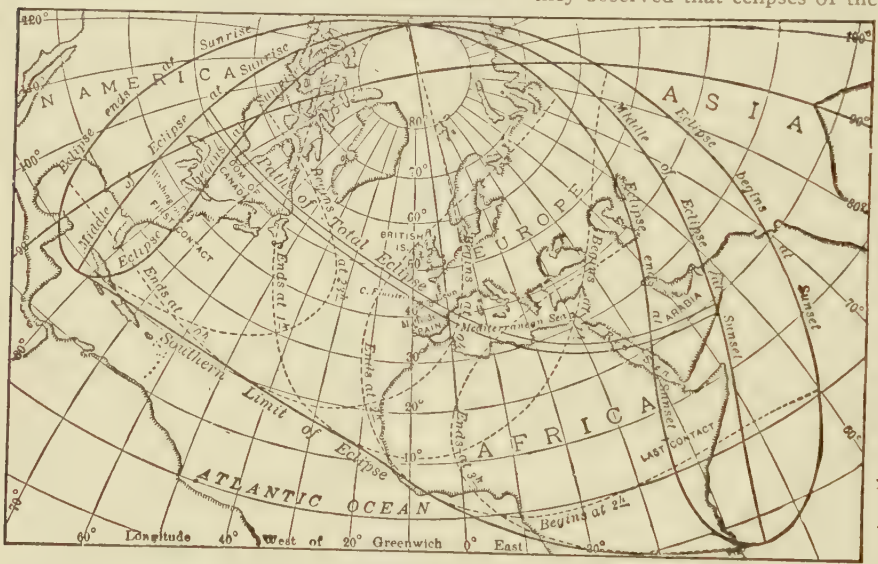


ECLIPSES.

S, sun; *E*, earth; *M*, moon; *P P*, penumbra.

SOLAR. When the sun and moon are in conjunction at the time of new moon, the moon is necessarily between the earth and the sun, the three bodies being in a straight line, as shown in Fig. 2. This causes an eclipse of the sun. If the moon's orbit were in the same plane as the ecliptic, an eclipse of the sun would occur at every new moon; but, since the orbit is inclined, an obscuration can occur only at or near a node. As a consequence of the diameter of the moon being comparatively small, the cone of the shadow cannot enshroud to exceed 180 miles in breadth of the earth's surface. Within this region occurs a *total eclipse,* and for a certain distance beyond only a portion of the sun's disc is obscured, where the eclipse is said to be *partial.* When the eclipse takes place at the time the moon is farthest from the earth, its disc does not cover the disc of the sun, thus leaving a ring exposed o the vision of the observer. This is known as an *annular eclipse.* The longest duration possible of a total eclipse of the sun in any locality is only about eight minutes.

An unusually interesting total eclipse of the sun occurred Aug. 30, 1905. In the accompanying illustrations are shown the path of the eclipse and the result of observations taken on board the *Lucania,* a vessel belonging to the Cunard Company, while at sea during a westward passage. At sunrise the path of the total eclipse came in contact with the earth near Lake Winnipeg, passed north of Newfoundland into the Atlantic, reached Spain at noon, passed over Northern Africa, and ended in Arabia. The maximum velocity was 2,000 miles per hour; average 1,000 miles; width of path of total eclipse, 160 miles; duration of totality, 2½ to 3¾ minutes. Cloudy weather made observations in Labrador unsatisfactory, but good results were obtained in Spain and Northern Africa. The Lick Observatory sent a party to Egypt, where a number of fine views were



PATH OF THE TOTAL ECLIPSE, AUG. 30, 1905.

taken with photographic telescopes. In that region the shadow bands were nearly parallel and moved as fast as a walking man. During the eclipse little variation was shown by terrestial magnetic elements.

LUNAR. Eclipses of the moon are caused by the moon passing through the earth's shadow, as shown in Fig. 1. They can only occur at full moon. The moon does not disappear completely even in a total eclipse, because of the refraction of the solar rays in traversing the lower strata of the earth's atmosphere. Since a *penumbra* surrounds the shadow of the earth, it sometimes occurs that the moon does not reach the true shadow, passing only partly within the penumbra. There never can be an annular eclipse of the moon, for the reason that the earth's shadow exceeds in diameter the moon's disc. Total eclipses of the moon are rarer events than those of the sun, yet are seen more frequently, for the reason that they are visible over the entire unillumined hemisphere of the earth, and also because of the long duration of the eclipse, which may last several hours.

Total solar eclipses at any given point on the earth's surface are exceedingly rare; prior to 1715 none had been visible at Paris, France, for five and a half centuries. In ancient times the people were very much frightened during an eclipse, and thought them presages of dire events. All manner of frantic efforts were made to drive them away. At one time the laws of Rome made it punishable blasphemy to talk publicly of their being due to natural causes. See **Sun; Moon.**

ECLIPTIC (ĕ-klĭp'tĭc), the apparent yearly path of the sun around the celestial sphere. It was so called by the Greeks for the reason that they observed that eclipses of the sun and moon can occur only when these bodies are near this circle. The earth's axis is not perpendicular to the plane in which the sun appears to move, but is inclined 23½°. If the stars could be observed in the daytime, the sun would be seen to be moving slowly among them toward the east, just as the moon does at night; this path is the *ecliptic.* Now, if the earth's Equator is imagined to be extended as a great circle into the heavens immediately above its true position, it is known as the *celestial equator* and cuts the ecliptic at the equinoxes. The position of the sun on March 21 and Sept. 21 is on the Equator or equinoctial points. Then, there are two periods in the year when the sun has reached its greatest distance from the Equator —June 21 and Dec. 21. These four points are distant from each other by a quadrant of a circle, or 90°. Each quadrant is divided into three arcs, or 30°, from which are reckoned twelve signs of 30°, called *signs of the zodiac,* being named from constellations through which the ecliptic passes. The equinoctial points are not fixed, but recede westward about fifty seconds in a year, while the angle at which the ecliptic stands to the Equator is diminishing also about fifty seconds in a century. The de-

crease, however, has a limit, and there is a point beyond which it can never pass. It requires 8,000 years to change a degree, and this can never sensibly affect the seasons.

ECLOGUES (ĕk'lŏgz), a class of pastoral poems, so named from the *Eclogues* of Virgil. The poems of this class relate the loves and adventures of shepherds and shepherdesses. Spenser's "Shepherd's Calender" is a good example of an English eclogue. Pope made this class of literature popular in the 18th century.

ECONOMICS (ē-kŏ-nŏm'ĭks). See **Political Economy.**

ÉCOLE DES BEAUX ARTS (ā-kôl' dā bō zär'), the national school of fine arts in Paris, France, founded as an academic school by Mazarin in 1648. The present name was not given to it until 1815, and a system of workshops were added to the main institution in 1863. It is situated in the Villa Medici, on the Pincian Hill, and takes rank as one of the most important schools of fine arts in the world. Both men and women between the ages of fifteen and thirty have free access to the courses which include drawing, sculpture, painting, engraving, architecture, modeling, and gem cutting. Foreign students are not subject to the age regulation and not eligible to the *Prix de Rome,* which was established in 1666. Students may remain as long or short a time as they desire, but the regular course is from eight to ten years. About 40 teachers give instruction, twelve in the workshops and 28 in the École proper, and the students number approximately 1,350.

ECUADOR (ĕk-wà-dōr'), a republic of South America, located mostly south of the Equator. It extends from 5° south latitude to 1° 45′ north latitude. Its northern and eastern boundary is formed mainly by Colombia; southern, by Peru; and western, by the Pacific Ocean. The boundary between it and Peru and Colombia has been in dispute for many years, hence the area cannot be stated with accuracy, but is usually given at 118,500 square miles.

Description. The surface is divided naturally into the extensive plains in the east, the elevated mountain regions through the center, and a narrow coast region lying between the latter and the ocean. Many of the mountains are active volcanoes, and the ranges are traversed by longitudinal valleys and plateaus. Two chief mountain ranges, both containing snow-clad summits, traverse the country in a direction from north to south, though the western of these has the more highly elevated peaks. It contains the highest summit in Ecuador, Chimborazo, elevation 20,500 feet, but its peaks as a whole are generally lower than those of the eastern range. The loftiest mountains of the latter are Antisana, Cayambé and Cotopaxi, the last mentioned being 19,612 feet. The sea coast is quite uniform, being indented only by the Gulf of Guayaquil. Many of the plateaus take the form of valleys among the mountains and their soil is generally fertile. In the eastern part of the country, east of the Andes, is an extensive fertile plain belonging to the Amazon basin.

A larger part of the country slopes toward the east, and the drainage is chiefly by tributaries of the Maranon, as the upper course of the Amazon is called. These tributaries include the Napo, the Putumayo, and the Japura, and some of these streams furnish transportation facilities with the Amazon. The rivers of the western slope are short and flow rapidly. They include principally the Mira and the Esmeraldas. Ecuador has numerous lakes, but all of them are small.

The climate is tropical, but is greatly modified by differences in altitude. Excessive heat and moisture render the eastern and western plains unhealthful, but some parts of the elevated interior are delightful, especially the valleys of the Andes that have an altitude of about 8,000 feet. The regions that have an elevation of more than 9,000 feet have a cold and rigorous climate, but habitations are met with at much greater heights in many of the mountains. It may be said that the dry and the rainy seasons form two divisions of the year, the former from June to November and the latter from December till May. In the deep river valleys the thermometer seldom registers below 80°, while the elevated summits are covered with snow perpetually. The rainfall is abundant in all parts of the country, hence fine grasses and thick forests are abundant. Tropical vegetation thrives in regions elevated less than 6,000 feet, and above that it becomes more rigid. Among the wild animals are the tapir, alpaca, jaguar, monkey, vicuña, and many birds of prey and plumage.

Agriculture. Farming is the chief industry and cacao is the principal product. It is cultivated extensively in the provinces of Oro, Manabi, and Guayas. Coffee takes second rank and is grown chiefly in the lowlands. Sugar cane is cultivated quite extensively. Indian corn, rice, tobacco, wheat, barley, and oats are grown profitably. The forests yield chinchona bark, sarsaparilla, vegetable ivory, and rubber, and the trees yielding these products are grown with considerable care. Alfalfa is cultivated for hay. All the domestic animals common to North American thrive, but sheep and cattle receive the larger share of attention.

Mining. Many minerals are found in the mountains, including coal, iron, zinc, and the precious metals, but very little has been done to develop the mineral resources. Gold is the chief mineral product, and copper and petroleum are obtained, though in comparatively small quantities. The lack of development may be attributed both to the lethargy of the people and a general lack of transportation facilities.

Manufactures and Commerce. The manufacturing interests are developed but slightly,

the most important products including flour, lumber, leather, cotton goods, clothing, and sugar. Coarse fabrics and straw braid used in making hats and other straw articles are produced in considerable quantities. Fruits and fish are canned to some extent for transportation. The exports usually exceed the imports. Foreign trade is chiefly with France, Germany, Great Britain, and the United States in the order named.

Most of the interior trade is carried by pack animals, owing to the fact that the highways are not improved and become almost impassable in the rainy season. A good highway is maintained most of the way from Quito to Guayaquil, the chief port. Not more than 265 miles of railways were in operation in 1900, the principal line extending from Guayaquil inland, but a line from Quito to Aquayaquil, about 300 miles in length, was completed in 1905. In 1908 the total lines in operation had a length of about 500 miles. Most of the telegraph and railway lines were built by foreign capital.

INHABITANTS. The population is composed largely of a mixture of Negroes, Indians, Spanish Creoles, and Whites. The white inhabitants are in possession of most of the land and manage the business enterprises, while the colored races engage in agriculture and hunting. It may be said that the Indians consist chiefly of two classes, of which the descendants of the Incas are the most numerous and most highly developed in civilized arts. Spanish is the official and spoken language, and Roman Catholic is the state religion, though other faiths are tolerated. Education has made little advancement among the common people, but a number of elementary and secondary schools are maintained. The national university is located at Quito. Quito, the capital, is the largest city and Guayaquil, on the Gulf of Guayaquil, is the chief seaport. Other cities include Cuenca, Riobamba, Latacunga, and Ambato. Population, 1922, 1,850,000.

GOVERNMENT. Ecuador is divided into sixteen provinces. The constitution vests the executive authority in the president and a ministry, and the president is elected for a term of four years. The congress consists of two houses, the senate and the house of representatives, the members of which are elected by direct vote, in the former for four years and the latter for three years. All male citizens who have attained to the age of 21 years and are able to read and write are granted the right of suffrage. The Indians were practically in a condition of slavery and were not represented until 1896, when they were admitted to citizenship under certain restrictions. A supreme court of six judges constitutes the highest judiciary. The standing army consists of only 3,500 men and the navy is not materially strong, being made up of a few torpedo boats and transports.

HISTORY. The early inhabitants of Ecuador were advanced in many of the arts of civilization, and they had many writings and records that were destroyed when their dominion was overthrown. At the time Pizarro conquered Peru for the Spaniards, Ecuador formed part of the great empire of the Incas. From 1564 until 1718 it existed as an independent presidency under Spain, and in the latter year became a part of the state of New Granada. A revolution in connection with adjoining countries against Spain secured its independence in 1822, when the Spaniards were defeated in the Battle of Pichincha, and in 1831 it was organized as a separate republic. The present constitution dates from 1906, and since then the country has enjoyed an era of reasonable progress.

EDDA (ĕd'dà), the name by which two ancient Icelandic works in literature are known. The term means "great-grandmother," and is a fitting appellation of this work, being an interesting forerunner of Scandinavian literature. The "Poetic Edda" was compiled in the 13th century and contains mythical poems, while the "Prose Edda" was written partly about 1230 and was discovered in 1628. The poems of the former praise the deeds of Scandinavian gods and heroes, while the latter treats of northern myths, exemplifies Scaldic poetry, and comments on the achievements of Haco of Norway, who died in 1263.

EDDY, Clarence, organist and composer, born in Greenfield, Mass., June 23, 1851. He first studied under Dudley Buck at Hartford, Conn., and later under August Haupt in Germany. In 1875 he returned to the United States and was elected organist of the First Congregational Church in Chicago, and subsequently held a like position in the First Presbyterian Church of the same city. In 1877 he was elected director of the Hershey School of Musical Art of Chicago. Concerts given by him at the Centennial Exposition in 1876 and the Paris International Exhibition attracted much favorable comment. In 1896 he was made a member of the Saint Cecilia Academy at Rome. Among his published works are a translation of Haupt's "The Theory of Counterpoint and Fugue" and "The Church and Concert Organist."

EDDY, Mary Baker Glover, author and moralist, born at Bow, N. H., July 16, 1821; died in Boston Dec. 4, 1910. She studied in her native town and afterward removed to Charlston, S. C., having married George W. Glover in 1843, who died of yellow fever the following year. In 1853 she married Daniel Patterson, a dentist of Tilton, N. H., from whom she was divorced in 1873. Four years later she married Asa G. Eddy, one of her students, who died at Boston in 1882. Her only child, George W. Glover, was born in 1844 and made his home in Minnesota and South Dakota most of his life.

In 1861 she met Dr. Phineas P. Quimby, from whom she took treatment and learned of his system of treating diseases without medicine.

MARY B. G. EDDY.

Mrs. Eddy fixed 1866 as the year in which she discovered Christian Science, to the teaching of which she devoted much time and careful study. In 1879 she established the first church of that faith in Boston and two years later opened the Metaphysical College. "Science and Health, with Key to the Scriptures," is her most widely known publication, which she issued in 1875, and nearly half a million copies have been sold. This work gives an outline of the understanding that Christian Scientists have of the Bible, and, besides it, she wrote many other publications and lectured extensively in support of her religious belief. In 1908 she was decorated with the jeweled insignia *an officer d'académie* of France. Her works include "Unity of Good," "The People's Idea of God," "Christ and Christmas," "The Pulpit and Press," "Christian Science versus Pantheism," "Retrospection and Introspection," "Messages to The Mother Church," "Yes and No," "Christian Healing," and "Miscellaneous Writings."

EDDYSTONE LIGHTHOUSE (ĕd'dĭ-stōn), a celebrated lighthouse of England, situated in the English Channel, on a group of rocks called Eddystone. Owing to tides covering the rocks daily, it became necessary to guard against shipwrecks at this point of danger. The first lighthouse was completed in 1700, but was destroyed by storm in 1703, and the second was burned in 1755. The third was a massive structure of limestone, with a granite inclosure at the foundation, and of sufficient height to cast a light thirteen miles. Owing to erosions at the foundation rocks by the action of sea waves, a new one was completed in 1882. This structure is the highest yet built at this place. It is equipped with the newer modern appliances and casts a light nearly 18 miles.

EDEN (ē'dĕn), the locality in which the first human family had its residence. In the eastern part of it was a garden, which was watered by a river and from thence the stream parted into four channels, though we have been unable to locate its exact place. Both the early Hebrew and Aryan writers believed that the human race first inhabited the mountains of Central Asia and that Eden was located in that part of the continent. At present it is generally assigned to Babylon and Armenia, with the preponderance of argument in favor of the former. The New Version of the Bible speaks of it as the Garden of Eden, and Milton calls it Paradise in his "Paradise Lost."

EDENTATA (ē-dĕn-tā'tà), or **Toothless Animals,** an order of mammalia established by Cuvier. The ant-eaters and pangolins are the only edentata that are absolutely destitute of teeth; but, with the single exception of the armadillo, which has one, none of the order have any incisor teeth, and the back teeth are very imperfect, being destitute of enamel and distinct roots. The sloths belong to one tribe of this order and alone subsist on vegetable food. The armadillos, pangolins, and ant-eaters subsist on insects or on animal substances in a decaying state. No fossil forms of the ant-eaters and sloths have been found, but the edentata is represented by the extinct Megatherium and other mammals of gigantic size.

EDGAR (ĕd'gar), called the Peaceable, son of King Edmund I., and one of the most distinguished of the Saxon kings of England. In 959 he succeeded to the throne, administered the civil and military affairs of his kingdom with marked energy and success, and gained the universal respect of his people. Being a patron of the monks, he was guided in ecclesiastical affairs by Saint Dunstan, Archbishop of Canterbury.

EDGAR, Sir James David, author and statesman, born at Hatly, Quebec, Aug. 10, 1841; died July 31, 1899. He was liberally educated and entered politics. In 1872 he was elected to Parliament, serving until 1874, and was reëlected in 1884, 1887, and 1891. He was an influential factor in securing the passage of a copyright bill in 1889, and for some time served as speaker of the House of Commons. In 1897 he was made a member of the Privy Council. His publications include "Canada and Its Capital," "This Canada of Ours, and Other Poems," and "The Insolvent Act of 1864."

EDGAR ATHELING, King of the Saxons, grandson of Edmund Ironside, born about 1057; died about 1120. He was born in Hungary, where his father was an exile, and was proclaimed King of England by the Saxons after the Battle of Hastings, but William the Conqueror displaced him. In 1097 he made an expedition into Scotland to reinstate his nephew Edgar as king of that country. Two years later he joined the Crusade, but returned to England and aided Duke Robert in his struggle against Henry I. The last years of his life were spent in England.

EDGEHILL, the locality of the first important battle of the Civil War in England. It was fought on Oct. 25, 1642, when King Charles had decided upon attacking London, but was met by 10,000 troops of Roundheads under command of the Earl of Essex. The army of the king numbered about 12,000, taking a stand on Edgehill, and their command rested largely with Prince Rupert. This commander led the right wing of the Royalists and made a gal-

lant charge upon the left wing of the Roundheads, pursuing them for several miles. The Roundheads inflicted a severe loss upon the royal infantry and succeeded in driving the opponents back. Though the Royalists suffered the heavier losses, the battle terminated as an indecisive struggle.

EDGEWORTH (ĕj'wûrth), **Maria,** novelist, born near Reading, England, Jan. 1, 1767; died May 21, 1849. She removed with her father to Ireland in 1782, and under his direction received a careful training in literature. In 1798 she joined her father in publishing "Practical Education," and soon after issued "Essay on Irish Bulls," the latter dealing with many incidents in Irish life. These were followed by many novels and other writings, all of which are interesting for their excellent sense and agreeable humor. They include "Popular Tales," "Stories of Ireland," "Leonora," "The Absentee," "The Parent's Assistant," and "Tales of Fashionable Life."

EDICT OF NANTES. See **Nantes.**

EDINBURGH (ĕd"n-bŭr-ô), the second city and the capital of Scotland, in the county of Midlothian, 46 miles east of Glasgow. It is located on a series of ridges and is surrounded on all sides by mountains, except the north, where the ground slopes gradually toward the Firth of Forth. The site of the ancient city was on the central ridge running from west to east, which is terminated on the north by a high, rocky cliff now containing the Castle, and on the east by Holyrood House. Castle Hill and Arthur's Seat, the latter 822 feet high, and several other lofty elevations overlook the city. Prince's Street, a fine promenade, divides the city into the two parts known as the Old Town and the New Town. Between the two parts are charming recreation grounds and the National Gallery and the Royal Institution. Cowgate Street and High Street intersect the Old Town and are the principal thoroughfares. Portobello, on the Firth of Forth, is included in the city.

Edinburgh is the seat of the supreme courts of Scotland and has several fine government buildings. Among the noteworthy structures are Saint Giles's Church, a beautiful edifice in the Gothic style; Victoria Hall; Tron Church; the Bank of Scotland; the Advocates' Library, with 490,000 volumes; the Signet Library, with 70,000 volumes; and a fine public library built by Andrew Carnegie. The Palace of Holyrood, which dates from the 12th century, had its origin in the abbey founded by David I. In the crown room of the Castle, located on Castle Hill, are the crown regalia, known as the *Honours of Scotland.* This building was the scene of many events in the life of Mary, Queen of Scots, and here her son James was born.

The city is noted for its progressive position in the management of public utilities, such as the systems of waterworks, sewerage, and gas and electric lighting. It is well connected by railroads and electric car and telephone lines, and has beautiful parks, boulevards, and paved streets. Among its leading manufactures are beverages, machinery, soap, clothing, paper, fabrics, and earthenware. The public school system is well established. It is supplemented by numerous high schools, academies, and the famous University of Edinburgh (q. v.).

Edinburgh is mentioned as having been the capital of the King of Northumbria early in the 7th century, and was named from King Edwin, a powerful monarch, who absorbed the Lothians and added them to his dominion. Robert Bruce made the city a borough and caused the establishment of a port on the Firth, now called Leith. It became the capital of Scotland in the 15th century, the first wall for its defense being built in 1450. After the defeat at Flodden in 1513, the walls were enlarged to include Cowgate. The English burned the city in 1544, and Queen Mary made it the seat of her short reign in 1561. When Scotland became united with England in 1707, the city was materially affected by the removal of the Scottish nobility, but in 1745 the Pretender made it his seat of action for a brief period. Population, 1921, 340,315.

EDINBURGH, Alfred Alexander William Ernest Albert, Duke of, Prince of Saxe-Coburg and Gotha, second son of Victoria, Queen of England, born at Windsor Castle, Aug. 6, 1844; died July 30, 1900. His early education was by special tutors. At the age of fourteen he entered the royal navy as a cadet, to serve in the Mediterranean and American waters, and declined the throne of Greece in 1862. In 1866 he was created Duke of Edinburgh, Earl of Kent, and Earl of Ulster, by Parliament, with a grant of $75,000 a year. He was given command of a frigate in 1867 and served in Australian waters, but later made an extensive voyage, visiting Japan and China. In 1874 he married Grand Duchess Marie, only daughter of Czar Alexander II. of Russia. He took the oath of loyalty to the German Empire in 1893, succeeding to the title of his uncle, the Prince of Saxe-Coburg and Gotha, Duke of Saxony. He was given the rank of general of infantry in the German army soon after, in which he rendered service of value.

EDINBURGH UNIVERSITY, a noted institution of higher learning in Edinburgh, Scotland. It was founded in 1592 under a charter granted by James VI., though it did not attain its higher sphere of influence until the early part of the 18th century. Originally it had only four regents, besides the principal professor. At present it has a faculty of 125 and maintains four extensive departments, including medicine, law, arts, and divinity, each conferring appropriate degrees on graduation. The government is vested in a body known as the sen-

ate, and the officers consist of a chancellor, rector, and principal. It is provided that the acts of the senate are subject to review by a university court, the members of which are appointed partly by the town court and partly by the university authorities. The present building of the university was begun in 1789. In its library are 2,500 manuscripts and 220,000 printed volumes, though this is supplemented by several large department libraries. In connection with it are numerous learned societies and museums devoted to natural history, general history, and anatomy. A number of fellowships and scholarships are granted annually. The number attending the different departments aggregates about 3,150. Some of the most eminent English teachers have been professors in this institution, and among its graduates are such prominent men as Scott, Carlyle, Goldsmith, and Darwin.

EDINBURGH REVIEW, a periodical established at Edinburgh, Scotland, by Sydney Smith in 1802. In this enterprise he was aided by Francis Jeffrey, Henry Brougham, Francis Horner, and a number of others. This publication was the first of the critical periodicals to be established in the 19th century. It exercised a wide influence in favor of the Whig party, but was relatively more important as a review of and factor in literature. Macaulay and a number of other eminent writers contributed to this periodical.

EDISON (ĕd'ĭ-sŭn), **Thomas Alva,** electrician and inventor, born in Milan, Ohio, Feb. 11, 1847. His early education was limited to the instruction given by his mother and the culture coming from reading and self-activity. Though studious on general lines, he directed his attention largely along the line of chemistry. He secured a position as newsboy on the Grand Trunk Railroad at the age of twelve years, and for a time published the *Grand Trunk Herald* in the baggage car of the train on which he was at work. Subsequently he became interested in studying telegraphy, most of his work being at night in a railway station, yet he developed into an expert. Soon after he was employed as an operator in several Canadian towns and afterward at Adrian, Mich. Besides attending to his duties, he fitted up a repair shop in which instruments were treated and improvements on existing machinery were attempted. While at Indianapolis he invented his automatic repeater, a device by which messages can be sent from one wire to another without an intervening operator.

THOMAS A. EDISON.

Edison's duplex telephone was invented at Boston, where he had been called by several men of means. He became connected as superintendent with the Gold and Stock Telegraph Company of New York in 1871 and in the same year transferred his shop to Newark, N. J. From this position he resigned after five years in order to devote his entire time to invention and research, locating at Menlo Park, N. J., from which he is often spoken of as the "Wizard of Menlo Park." Later he established his home and headquarters in Newark, N. J. He secured about four hundred patents on inventions and improvements along different lines of instruments and machinery. Among the most useful, besides those mentioned above, are the phonograph, improvements on the electric light and the telephone, the electric pen, the microphone, the megaphone, the kinetoscope, the microtasimeter, and the quadruplex and sextuplex transmitters. In 1915 he was made chairman of the Naval Consulting Board, an organization created to improve the navy.

EDMONTON (ĕd'mŭn-tŭn), a city of Canada, capital of the province of Alberta, 800 miles northwest of Winnipeg. It is located on the Saskatchewan River and on the Canadian Pacific, the Canadian National, and other railways. The features include the Macdonald Hotel and the University of Alberta. Coal, gold, silver, and platinum are mined in the vicinity. The principal buildings include those of the government, the public library, the city hall, the high school, and a number of substantial churches. The public utilities, including electric lights, waterworks, sewerage, and a gas plant, are well established. It is the center of a vast region which is easily reached by railways, hence is a growing market and has a large retail and wholesale trade. Strathcona was annexed to Edmonton in 1911. Population, 1921, 58,821.

EDMUND (ĕd'mŭnd), the name of two early kings of England. Edmund I. succeeded his brother, Athelstan, in 940. In his vigorous reign Cumbria was conquered and bestowed on Malcolm, King of Scotland. While at a banquet, on May 26, 946, he was slain. Edmund II., called Ironside, eldest son of Ethelred II., was born in 989. A division caused the two political parties to elect both him and Canute as king, the former in 1016. Though victorious over Canute in several battles, he was defeated in Essex, and compelled to cede large tracts of territory. His reign terminated by his death in about seven months, and Canute became king of the whole of England.

EDMUNDS, George Franklin, statesman, born in Richmond, Vt., Feb. 1, 1828. His education was received in the public schools and by instruction under a private tutor. Later he studied and practiced law, and was a member of the Legislature of Vermont from 1854 to 1859, serving three years as speaker. In 1861-62 he was a member of the State Senate, serving as

presiding officer pro tem. Soon after he was appointed to fill a vacancy in the United States Senate, in which he was distinguished as an opponent to President Johnson in his reconstruction policy and favored his removal from office. He was elected by the Legislature in 1866 to fill the unexpired term of Solomon Foot and remained in the Senate consecutively until 1891, when he resigned on account of impaired health. Edmunds served as a member of the electoral commission of 1877, casting his vote for R. B. Hayes. After Arthur was elevated to the Presidency, he became president pro tem. of the Senate. Among the best known of the many important laws written by him is the act for the suppression of polygamy in Utah, which is known by his name. As a parliamentarian and skilled legislator he took very high rank. He died Feb. 27, 1919.

EDOM (ē′dŭm), meaning *red,* the name given to Esau on account of the red pottage secured by him from his brother Jacob. The name was also given to the country settled by Esau, having been previously known as Mount Seir. It was about 100 miles long and twenty miles wide and was situated between the Dead Sea and the Gulf of Akabah, an inlet from the Red Sea. Bozrah, now Buseirah, situated in the extreme northern part, was its chief city and the capital. During the reigns of David and Solomon, Edom was under subjection to the Israelites. Later the Edomites ravaged the southern borders of Palestine, and were denounced with considerable vehemence by some of the prophets of Israel. After the destruction of Jerusalem, in 70 A. D., the name of Edom or Idumaea disappeared from geography.

EDUCATION (ĕd-ū-kā′shŭn), a word derived from the Latin *educare,* meaning to lead forth. In a philosophical sense education is the natural inheritance of every individual, since he is impressed and developed for good or evil by all with which he comes in contact, everything he sees, feels, hears, and does influencing action and forming tendencies. According to this view, education begins with parental influence and terminates only when life ceases. The more common application of the term involves the efforts premeditated by parents and teachers to induce exercise of the powers of the learned in such a way as to become the most possible in physical strength, intellectual power, and moral goodness. To accomplish this high ideal, those instructing need to know the laws under which human development makes the most efficient progress; they must understand the possibilities of the student, and also be capable to administer precepts and examples to good purpose, in the process encouraging what is good to the individual and discouraging the tendencies that may result in harm.

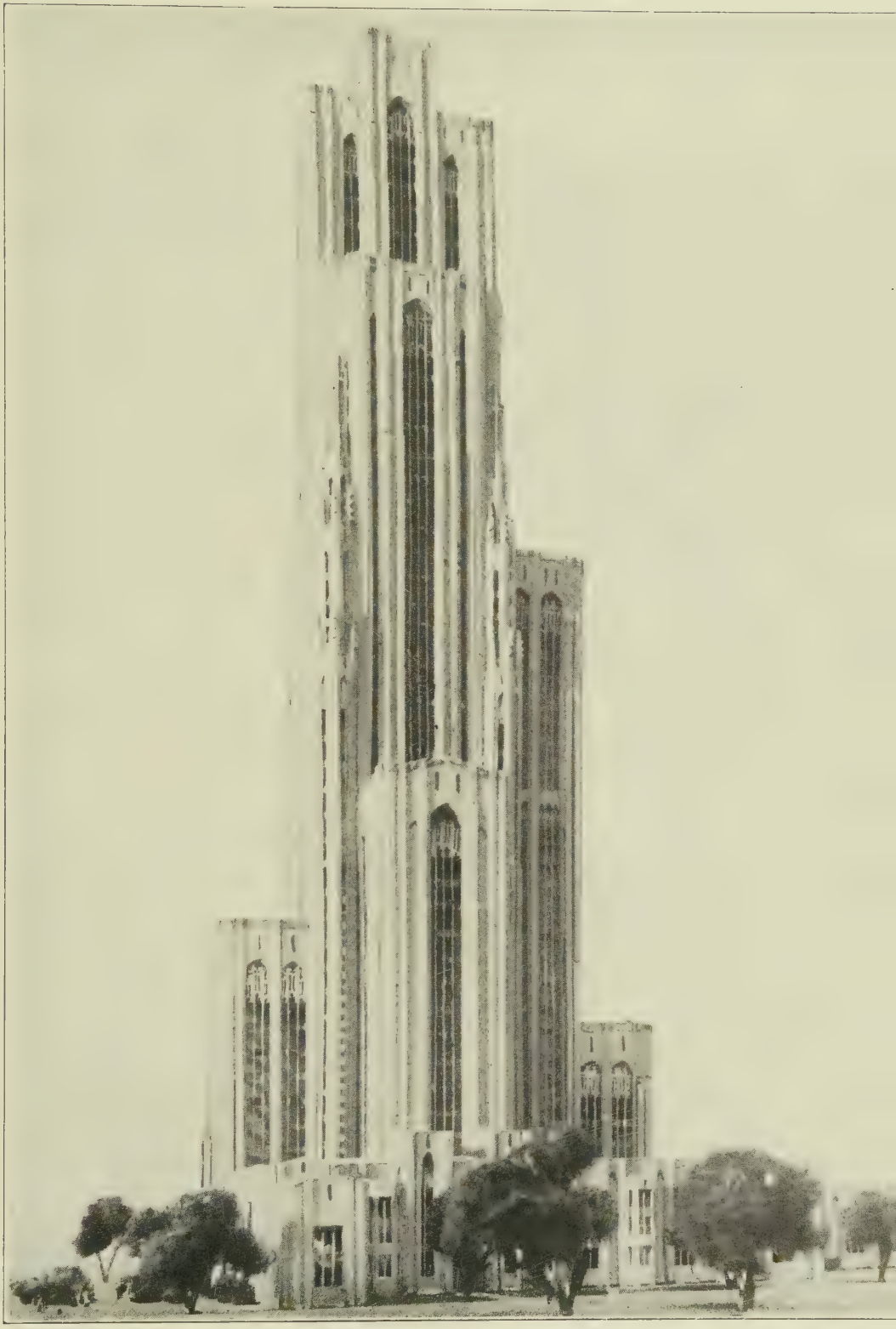
Fundamentals. In a rational system of education it is necessary to enrich the life of every member of society with the fundamental elements and basic principles that underlie true development. This should be done for the universal good, and to the fullest extent of the personal capacity of each individual. In addition to the general culture that ought to be secured to all, there should be more or less technical training to fit for the calling in life by which the learner desires or is likely to support himself. Such an education necessitates a well-organized system of elementary schools at which all may be trained, secondary schools for a smaller number, and colleges and universities for those expecting to assume higher responsibilities or enter the learned professions.

However, education is not creative in its nature. Its aim is to attain the fullest development and highest right activity of the faculties of the body, mind, and soul. To accomplish this it is necessary to cultivate by right activity all the pliant, plastic innate powers by means of a continuous culture well adapted to individual needs. The culture must aim at harmonious training of all the faculties, having for its object the development of existing possibilities into realities. It must take account of every need in order that the highest possible form of learning, development, and efficiency may result.

Threefold Aim. The true aim in education is threefold and deals with the physical, intellectual, and moral. *Physical culture* should train the body that it may be strong, healthy, vigorous, graceful, skillful, and responsively active to the will. *Intellectual training* should engage the mind with and develop the love for knowledge, qualify for the independent acquisition of knowledge, and prepare for regular practice in the use of knowledge. *Moral culture* should strengthen the conscience and will by the formation of habit in carrying out pure feeling and good thought, to secure ready obedience to law as the embodiment of right, induce a consciousness of individual power and responsibility, and implant self-faith as the result of faith in a divine Providence.

Educational Systems. The systems of schools for the general dissemination of education have been and still are greatly diversified in courses of study, and the scope of education itself has shown marked differences in all ages and civilizations. All the countries that take some rank in educational arts maintain at least a portion of the general system that should be fostered in all highly civilized states. A complete system of the schools involves the establishment of many institutions with diversified courses of study, each aiming to cover its portion of a general system, and articulating in a well-connected way with others.

Among the schools recognized by the leading nations are: 1. *Kindergartens,* schools in which the young are trained to develop right activity of the body, though some attention is usually given to elementary growth in intellect. In



(Opp. page 872) CATHEDRAL OF LEARNING, PITTSBURGH

This illustration shows the proposed building which is to be the home of the Pittsburgh University at Pittsburgh, Pa. It will have 52 stories, cover about two acres of the fourteen-acre campus, have a height of 680 feet, and cost $10,000,000. Sixteen high-speed elevators will transport the faculty and students to the different floors.

communities not recognizing this class of schools essential in the process of education, the elementary work is done largely in the homes by mothers or private teachers. 2. *Common schools,* institutions designed for teaching the rudimentary branches, with courses of study so graded as to prepare the pupil for the various higher institutions. 3. *Schools of agriculture,* comprising courses in gardening, botany, horticulture, geology, vegetable chemistry, zoölogy, pomology, and surveying. 4. *Industrial schools,* including the teaching of industrial labors and work and the arts of trade. 5. *Schools of fine art,* those designed for educating artists in the various fine arts, such as sculpture, painting, music, poetry, and architecture in its character as art. 6. *Schools of technology,* institutions designed to teach civil, electrical, and military engineering, geology and mining engineering, photography, engraving, building, navigation, telegraphy, and astronomy. 7. *High schools,* institutions having courses of study covering higher branches of learning than the common schools, and designed to prepare pupils for institutions in which they may secure such training as will best fit them for their vocation in life, among them those named below. 8. *Schools of business,* in which students are trained in all classes of business, such as banking, commerce, manufacturing, and office work. 9. *Law schools,* institutions for the education of lawyers. 10. *Normal schools,* the institutions established exclusively for the education of teachers. 11. *Schools of medicine,* those containing courses and facilities for the education of surgeons and doctors of medicine. 12. *Colleges,* institutions where the highest branches of knowledge and science are to be taught, and having courses designed to prepare a corps of men devoted exclusively to culture and science. 13. *Universities,* the highest institutions of learning, in which the most extended courses of study are offered to men and women who aspire to the more learned attainments in the arts and sciences, and to fit them for the greatest activity and highest good in the professions of law, medicine, ministry, and teaching, and for philosophical work. In each class the highest development of the moral faculty is to be made an objective point, which is the case in all the schools of the most progressive nations. The higher lines of education, above the basic, have been designated as moral, political, aesthetic, philosophical, and religious.

History. The history of education is concerned, more or less, with every epoch from which any record has passed down to us. Few studies are of deeper interest than the one that traces the systems under which man's influence upon nature was enlarged through the successive centuries, and by means of which he attained his present high development. Whether man in the beginning occupied a higher or lower status than at present has been a subject of controversy from remote times, though, so far as profane history is concerned, it is evident that he has been enabled to attain greater power and influence through the impulse of educational arts. Sacred history represents the first parents created in the image of God, and accords them efficiency to reason and converse with each other. Cain was not only a tiller of the soil, but is represented as a builder of a city which he named Enoch, after his firstborn son. In the seventh generation from Adam, and while that patriarch still lived, it is recorded that Tubal-Cain "was an instructor of every artificer in brass and iron," and that his half-brother, Jubal, "was the father of all such as handle the harp and the organ."

While it is impossible to determine the exact status of antediluvian education, it is evident that in the twilight ages man advanced materially in civilized arts. The invention of the organ and the harp, and the skill of artificers in brass and iron, imply that many others and related discoveries and inventions had been made. However, advancement in education dates from and is measured largely by the art of writing, this art being considered the prime meridian from which to measure. Committing thought to writing made it possible to pass funds of knowledge from generation to generation with much better results than by story and tradition. Besides, all succeeding generations were enabled to ponder the achievements of preceding ages, as well as profit by the failures and successes of the generation that preceded them. The writings were not necessarily made up of such characters as are used exclusively by the Caucasians at present, but included various forms of hieroglyphics and symbolical characters on monuments, stones, and architectural structures.

Oriental Nations. Among the early civilizations and antiquities the Chaldean, Babylonian, and Assyrian take high rank, and much knowledge of their skill and progress has come to us through various sources by means of monumental writings and architectural ruins, most of which are given us by the Greek historian, Herodotus, and the German, Max Müller. The rise of the Chaldean civilization dates from Nimrod, about 2300 B. C., when Babylonia was founded. These ancient peoples erected great cities, collected vast libraries, founded schools, and disseminated knowledge and learning for many centuries. Passing from their settlement on the Tigris and Euphrates to Egypt, we find a high state of civilization and a wide range of culture that had their beginning more than 4,000 years ago. In their city of Alexandria was a great university, which taught a system of geometry perfected by Euclid, and in accord with which and other productions the Egyptian intellect towered and expanded, attaining a foothold almost as durable as their gigantic pyramids and the time-enduring sphinx. Their

system of education, like that of India, was largely characterized by the baneful influence of castes, resulting in classes who towered as educational giants on the one hand, and descended to the status of intellectual pigmies on the other.

In scrutinizing human history it is remarkable that practically every portion of value in education comes generally from the Caucasian race, the Mongolian being the only other race that presents any original theories and primitive acquirements of material knowledge. The educational system of China dates from Confucius, who lived about 500 years before Christ, and ever since his teachings have had a marked influence upon the Chinese and some effect among the Japanese, though Brahmanism and Buddhism have had more or less influence upon the education of both peoples. China still adheres closely to the educational theories and practices of the ancients, neglecting the education of women, but grading promotion in state affairs entirely upon educational merit, while Japan is breaking away from the old with remarkable rapidity and inaugurating schools and courses of study maintained in the systems of modern states. The latter people are distinguished by greater energy and independence of character than the Chinese, and are willing to inaugurate the newer and better, even if many traditional and time-tested institutions must be set aside.

Ancient Classical Nations. From Western Asia and Northern Africa education moved westward to Greece, and eventually from Greece to Rome. According to the writings of Homer, it is certain that the early education of Greece was patriarchal. Later four divisions arose, of which the Dorians and Ionians are the most noteworthy. The seat of influence of the former was at Sparta, and their higher education was largely the outgrowth of the codified laws of Lycurgus, though the teaching of Pythagoras influenced the whole of Greece by its strictness and aristocratic tendencies. Solon codified the laws of the Ionians. Their center of influence was at Athens. Socrates, Plato, and Aristotle are the great teachers of Greece, and rank highest in power and influence.

Numa Pompilius founded Roman education, though Greek culture was introduced in its entirety about 250 B. C. The great orator, Cicero, gave perfection to Roman rhetoric, while Seneca and Quintilian rank as the greatest educational writers. Greek education aimed to develop especially the beautiful and good. The Greeks as well as the Romans maintained a highly educated priesthood, though education was extended to all save the slaves and extremely poor. The young were trained early in life. Physical and intellectual strength were objective in all, while their religious culture consisted of the worship of representative gods, such as we read of in mythology. These were sacredly represented in statuary, temples were built to their honor, and the young were admonished to do them reverence.

Early Christian Era. The influence exercised by the teachings of Christ is the most marked and contains the essential and basic principles of education. They oppose all external distinction among men, recognize the equality of women, and make capability the only limit of man's development. By their precepts man is taught to become perfect, and live, grow, be active, avoid stagnation, and seek progress and expansion. Its injunctions require activity, according to the talents possessed. Those who have the greater capabilities are presumed to accomplish the most and serve the higher and more useful purposes in society. Upon these principles of teaching every true system of modern education is based. They sustained the severest criticisms of the Middle Ages, were embraced by the early educators of modern times, and permeate the writings of the great master teachers.

Education in Europe. The Reformation (q. v.) is the beginning of the great epoch of modern education in Europe. Promoted by Luther, Melanchthon, and Wycliffe, it taught the doctrine of justification by faith alone and the necessity of reading the Bible. This caused the Scriptures to be translated into the modern tongues and gave rise to schools which taught the people to read and write. Ultimately it made possible the great universities, such as those at Oxford, Cambridge, Edinburgh, Berlin, Paris, and Vienna. Among the teachers and writers who influenced educational thought in Europe are Bacon, Comenius, Locke, Francke, Rousseau, Kant, Fichte, Richter, Hegel, Rosenkranz, Herbart, Beneke, Pestalozzi, Froebel, and Spencer. Germany has been rightly named the *land of pedagogy,* and the influence of its great teachers has been felt in every civilized country. Its institutions have long had the highest reputation on account of their excellence for training teachers and inducing education, from the kindergarten system to the colleges and universities.

The education of modern Europe is largely statal, attendance is free and compulsory, and the courses of study cover, not only branches of classic learning, but disseminate knowledge and skill in the arts of industry. The primary schools have been given over entirely to women teachers, while grammar grades, higher instruction, and supervision are limited almost exclusively to men. Institutions and associations of teachers are maintained and exercise influences similar to those in America, while periodicals and books devoted to pedagogy are read extensively. The newer statistics place Sweden in the highest rank among the nations of the world on account of its common school education, illiteracy there being limited to the lowest per cent. It is impossible to speak of all the many excellent qualities of European schools in this article, and it may be sufficient to say that

all the progressive nations of Europe, and, for that matter, of the world, are giving closer attention to the building of schools and the education of the young for the state and for life than in any other period of history.

Education in America. Education has been a profound study in America, though the United States and Canada represent its greatest development and most marked influence. The representative form of government makes it necessary to educate universally, else our civil institutions must fail. The dangers of universal suffrage can be overcome only by universal education. In recognition of this fact legislation along educational lines was early directed to the building of schools and the founding of colleges. Massachusetts led the way in 1632 by requiring all children to be taught to read and write. Later, when the United States was established as an independent government, Congress set aside lands to aid schools, and in the newer states and territories sections sixteen and thirty-six of each township were reserved for that purpose. Normal training schools for teachers are maintained in nearly all the states by public taxation, at which admission is free, and through whose influence a strong profession of teaching is developing. The Commissioner of Education is an important officer of the Federal government, whose influence for good by means of treatises, lectures, and published reports is widening constantly in the entire nation.

The states maintain either State commissioners or superintendents of public instruction, while county superintendents and, in some states, commissioners, have local supervision. Teachers are called to convene in conventions and institutes by proper authorities, and are certificated to teach either by local officials, county superintendents, or State boards of examiners. In most of the states school attendance is nominally compulsory and in all it is free of tuition. Some states maintain free schools devoted to the industries and higher learning, though many of such institutions are aided by the Federal government. Public schools are open and alike free to both sexes, but in a number of Southern States separate schools are maintained for the education of Negro children. Besides the public schools and higher institutions, there are many denominational and private schools, colleges, and universities. Collectively they represent an immense capital and wield a marked influence for good. In states which have compulsory laws, attendance at private schools, which have courses similar to the public institutions, is considered to be in compliance with law. Among the most prominent educators that have exercised a large influence in shaping educational theories we may name Kant, Richter, Hegel, Asa Gray, Herbert Spencer, Herbart, Rousseau, Froebel, Pestalozzi, Horace Mann, Aristotle, Socrates, Plato, Fichte, Rosenkranz, Haeckel, Max Müller, Locke, and Jonathan Edwards, all of whom are treated in special articles. To this list may be added the following American educators of recent date: G. Stanley Hall, W. T. Harris, David Starr Jordan, William R. Harper, Herman Eduard von Holst, Andrew Dickson White, George Payn Quackenbos, Joseph Baldwin, C. W. Eliot, Francis Wayland, W. M. Beardshear, Samuel Eliot, E. E. Brown, Philander P. Claxton, etc.

EDUCATION, Commissioner of, the title of the chief officer of education in some states and countries. The term is applied interchangeably with that of superintendent, though in some states and provinces it is recognized as the exclusive title. It is the duty of a commissioner of education to supervise the general management of schools and public institutions, and to publish recommendations and biennial reports upon the methods of teaching and the management of educational system. In Canada various names are used in speaking of officials who have charge of educational work, such as minister of education, in Toronto; superintendent of education, in Nova Scotia; and commissioner of education, in Saskatchewan.

The Commissioner of Education of the United States is the chief officer of the national Bureau of Education. He is appointed by the President with the consent of the Senate. The duties are to collect educational statistics, diffuse information regarding the organization and management of schools and school systems, to promote the cause of education, and to present annually to Congress a report embodying the result of his investigations and labors. The office was established in 1867 with Henry Barnard as the first commissioner.

EDUCATION, Compulsory, the term applied to the system of education in which attendance is required by the state for some fixed period. Nations have long recognized the importance of training youth for citizenship, hence attendance upon some schools has been compulsory, though in most cases the parent may select the particular school at which the child is to attend, that is, the parent may choose to enroll the pupil in a public school or in a private institution where work of the same kind is done in certain branches. The law varies in fixing the compulsory period, usually beginning with the ages of five to seven years and extending to the ages of fourteen to sixteen years. In a majority of countries the compulsory period is eight years.

Since the state requires all of its citizens to pay taxes toward the support of the schools, it is held reasonable that the citizen should expect all children to get the advantages of an education. Since the safety of society is dependent upon morality and intelligence, it is quite essential to the state that no one should grow up without receiving proper training for the responsibilities of citizenship. Compulsory

attendance laws were in force among the ancient, especially in Sparta and Athens, where training in military affairs and other branches was required. Germany has had a compulsory attendance law for many years, and similar laws are on the statute books of Great Britain, Sweden, Denmark, Switzerland, and France. In the United States and Canada they are enacted by the State or Province, since these countries do not retain supervision over the public schools, but instead delegated this part of the government to the individual states and provinces. Truant officers are provided for by the laws, and such officers are usually appointed by the local boards of education. It is their duty to see that the attendance law is enforced, and parents are subject to a fine where the child is not in attendance in compliance with the law, though they cannot be punished without due trial. The employment of very young children in mines and factories has made it quite necessary that these laws be enforced.

EDUCATIONAL ASSOCIATION, a society of teachers and educators to study methods and promote educational work. Many forms of societies of this kind are maintained. Local organizations are usually made up of the teachers and educators in a particular city or in a county, and these are tributary to the educational association of the State or Province. Societies organized within a city or county usually meet several times each year, while those of a State or Province hold meetings annually, and in these the work is assigned to different departments, such as that of elementary schools, high schools, and institutions of higher learning. In many states teachers are required to attend the meetings, and are paid for their attendance the same as if they were teaching in the schools.

The National Educational Association of the United States was incorporated in the District of Columbia in 1896, when it succeeded the National Teachers' Association, which was organized at Philadelphia, Pa., in 1857. This association meets annually in different parts of the country, and at these meetings prominent educators read papers or lecture upon topics of interest to teachers in the management of schools or the supervision of school systems. A complete report of the proceedings, including the principal papers and lectures, are published for the benefit of the members. This association has had a marked influence upon public instruction, especially by its celebrated report of the Committee of Ten in regard to secondary schools. It consists of seventeen departments and the National Council, the latter being a board which exercises general advisory power. The largest meeting of the association was held at Boston, Mass., in 1903, when 34,983 members were registered.

EDWARD (ĕd'wĕrd), known as the *Elder,* King of England, ascended the throne in 901; died in 925. He was the son of Alfred the Great, whom he succeeded, but his right to succession was disputed by Ethelwald, who was killed in battle in 905. His reign was disturbed by wars against the Danes, but he subdued them and the native opponents as far as the Humber, and was recognized as overlord in the island.

EDWARD, called the *Black Prince,* son of Edward III., born in 1330; died in 1376. He was so named from the color of the armor worn by him. See **Edward III.**

EDWARD, called the *Confessor,* last of the old royal line of Anglo-Saxon kings, born in Oxfordshire, England, about 1004; died Jan. 5, 1066. He obtained possession of the throne in 1042, when he succeeded his half-brother Hardicanute as king. A number of attempts to establish his authority in England were ineffectual, and he lived in Normandy during the period preceding his succession. His reign was marked by the influence of foreigners, who exercised much power over him, and is characterized by many struggles between the court party, or Normans, and the old Anglo-Saxon party, the latter being under the leadership of Earl Godwin and his son Harold. Several wars with the Welsh terminated to his advantage, and foreign invasions were repelled successfully. History places him among the spiritless rulers of England. However, Pope Alexander III. canonized him in 1161. He was succeeded by Harold, son of Earl Godwin, though it is held usually that the old English monarchy perished with him, largely for the reason that his immediate successor ruled only a few months.

EDWARD, surnamed the *Martyr,* King of England, born in 963; died in 979. He was the son of Edgar and succeeded him to the throne in 975. His stepmother Elfrida intrigued against him in favor of her own son Ethelred, but his right was recognized through the powerful influence of Saint Dunstan. He was assassinated through the intrigues of Elfrida.

EDWARD I., King of England, the elder of the two sons of Henry III., born at Westminster, June 16, 1239; died July 7, 1307. In the early struggle between the nobles and his father he sided with the former, but in the war that followed he showed vigorous generalship on the side of the king. When Pope Gregory X. instigated the last of the Crusades, he took part in it and landed at Acre in 1271. On learning of his father's death, he proceeded to France to do homage to the French sovereign, having been proclaimed king immediately after his father's demise, and reached England about two years later. His vigorous policy and great activity caused his reign to rank among the most important in the constitutional history of England. Soon after succeeding to the throne he directed a military expedition against the Welsh, bringing them under subjection after a contest of nearly ten years, the principal events being the death of Prince Llewellyn and the execution of

Prince David. On account of the excessive usury practiced by the Jews, he issued a proclamation in 1290, by the terms of which 16,000 were banished from the kingdom.

The contest for the Scottish crown induced Edward to assert his claims, causing the ten contestants to acknowledge him lord paramount of Scotland. In this way he was enabled to decide upon the rights of the competitors, and gave his decision in favor of John Baliol, in 1292, who swore fealty to him. Baliol soon renounced his allegiance and a war broke out, which resulted in Baliol's surrender and exile. To make peace with the nobles of England, he approved the Great Charter, by virtue of which the people were enabled to determine for themselves the amount of taxes to be levied. In 1297 William Wallace, a Scottish chieftain, collected a large army for the purpose of securing the freedom of Scotland, defeating the English at Stirling, but he was subdued by Edward at the famous battle of Falkirk, and was later executed as a traitor.

To adjust difficulties with Scotland, he prepared a new constitution, in which Scottish representation in the English Parliament was authorized, but the measure was not fully accepted by the Scots. Robert Bruce organized a powerful army in 1306 once more to battle for Scottish independence. Edward started with his army to subdue him, but died at Carlisle while within sight of the country that he had planned to subdue. He is accorded a place in history among the most liberal and enlightened monarchs of his age. The civil service, internal improvements, and rights of the people were extended largely during his reign.

EDWARD II., King of England, son of Edward I., born in Carnarvon, Wales, April 25, 1284; slain Sept. 21, 1327. Being the first heir apparent to the throne of England, he was created Prince of Wales—the first to bear the title. He accompanied the expedition led by his father into Scotland, but returned home soon after and followed a life of vice and contempt, succeeding to the throne in 1307. His reign was influenced by favorites, among them Piers de Gaveston and Hugh le Despenser. The former was left as guardian of the kingdom in 1308, while Edward proceeded to France to conclude a marriage with Isabella, daughter of Philip V. This was so objectionable to the nobles that Gaveston was captured and hanged June 19, 1312. In 1314 Edward invaded Scotland at the head of a large army, but was defeated with great slaughter by Bruce at Bannockburn, by which the Scots became independent. Soon after Despenser began to influence Edward, which greatly weakened him with the nobles. To adjust difficulties with Charles IV., of France, Edward sent his wife thither. Despising both the Despensers and her husband, she landed on the English shore with an army in 1326, defeated the king, and caused the Despensers to be executed. Being compelled to resign the crown, Edward was cast in prison, and soon after was murdered in Berkeley castle.

EDWARD III., King of England, son of Edward II., born at Windsor, Nov. 13, 1312; died Jan. 21, 1377. He was proclaimed king in 1327. The country was governed during his minority by a council of regency, though really by Queen Isabella and her paramour, Roger Mortimer. In 1330 he determined to assume power and accordingly put Mortimer to death, sending his unworthy mother away. Soon after he invaded Scotland to assist Edward Baliol, and defeated the Scots at Halidon Hill. Subsequently he claimed succession of the throne of France through his mother, a sister of Charles IV., and led a powerful expedition against Philip VI., which resulted in many daring exploits. To maintain his army excessive taxes were laid on the people and valuable concessions were made to the nobles. His eldest son, known as the Black Prince, aided materially in conquering large portions of Normandy, and in capturing the city of Calais after a siege of twelve months.

The war was renewed between England and France in 1355, and the following year the Black Prince captured King John of France at Poitiers. Soon after a peace was concluded by which Edward secured many advantages. The next war between France and England terminated disastrously to the latter country, and Edward was obliged to return home. He soon quarreled with Parliament and became at variance with the nobility, and many important functions of the government were assumed by his third son, John of Gaunt. The Black Prince died June 8, 1376, and Edward survived him about one year. His reign was quite successful, being accompanied by reforms in the national judiciary, extension of commerce, and industrial improvements.

EDWARD IV., King of England, son of Richard, Duke of York, born at Rouen, France, April 29, 1441; died April 9, 1483. The contest between the two families of York and Lancaster was in full sway during his minority. At the Battle of Wakefield, in 1460, his father was slain and Edward became the natural head of the Yorkist party. The victory in the Battle of Mortimer's Cross enabled him to enter London, where he was hailed as king. His title to the throne was established by the great Battle of Towton, though Margaret, Queen of Henry VI., kept up a desultory struggle in the north for some time after, which was ended eventually by the capture of her husband. His early popularity was weakened by the marriage to Elizabeth Grey, daughter of Lord Rivers, a Lancastrian, but in the battle that followed he was successful. He gave evidence of cruelty by confining Henry VI. in the Tower until death and by murdering Margaret's son. His extended quarrels with Parliament led to much dissatisfaction, during which he carried on the

government by compelling loans from men of wealth and conducting trade with merchants' ships. In his reign printing and the manufacture of silk were introduced in England.

EDWARD V., King of England, son of Edward IV., born Nov. 4, 1470. He was a lad of thirteen when his father died and with his younger brother, Duke of York, was shut up in the Tower by Richard of Gloucester, who had been appointed protector of the kingdom. The two unfortunate boys were never again seen, and it is believed that they were murdered by the order of the protector. Many attempts have been made to clear him of the suspicion, but all have failed.

EDWARD VI., King of England, son of Henry VIII. and Jane Seymour, born Oct. 12, 1537; died July 6, 1553. Such learned men as Roger Ascham taught him, and when only ten years of age he succeeded his father on the throne under the protectorship of his uncle, Edward Seymour, afterward Duke of Somerset. The latter invaded Scotland for the purpose of compelling Mary Queen of Scots to marry Edward, but he was compelled to return to England on account of the intrigues of the Earl of Seymour, his brother, whom he executed. Later Somerset was beheaded on a charge of treason made largely through the intrigues of Dudley, Earl of Warwick, who also married his son to Lady Jane Grey and induced Edward to make her his successor. It is thought that the death of Edward resulted from the effects of poison. His short reign was marked by many important events, though they were not brought about by his influence, since his death occurred at the early age of sixteen years. Among the events may be named the establishment of Protestantism in England, publication of the "First Prayer-book" of Edward VI., and many reforms in internal and commercial laws.

EDWARD VII., King of Great Britain and Ireland, Emperor of India, eldest son of Prince Albert and Queen Victoria, born Nov. 9, 1841; died May 6, 1910. He was trained by tutors under the supervision of his father, after which he attended the universities of Oxford and Cambridge. He made a visit to the United States and Canada in 1860, and two years later traveled in a number of Asiatic countries, including the Holy Land. In 1863 he married Princess Alexandra of Denmark, a daughter of Christian IX. In 1875 he made a visit to India, and traveled through various parts of Ireland in 1885.

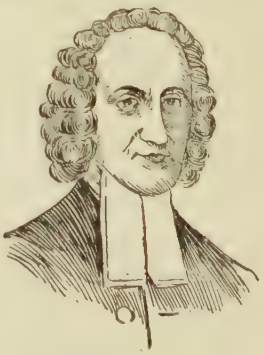
EDWARD VII.

On the death of Queen Victoria, Jan. 22, 1901, he ascended the throne, declaring himself determined to maintain the constitutional form of the government. He was crowned on Aug. 9, 1902.

Edward was a lover of outdoor sports and a leader in the social life of England. He had a high standing in the councils of the Freemasons of England, of which he was elected Grand Master in 1874. His personal acquaintance among the courts was extensive, both in Europe and the East, and he was recognized as a factor in the politics of the world at an early period of his reign. His six children include Albert Victor (1864-1892), Duke of Clarence and Avondale; George Frederick, Ernest Albert, now George V.; Louisa Victoria, the Duchess of Fife; Victoria Alexandria; Maude Charlotte, the Queen of Denmark; and Alexander John, born and died in 1871.

EDWARDS, Amelia Blandford, novelist and Egyptologist, born in London, England, in 1831; died April 5, 1892. She manifested an interest in literature at an early age, and in 1853 became noted as a contributor to several magazines. Her reputation is based largely on her novels and travels, though she produced a number of educational works, these being largely abridgments of French and English history. Her travels extended through Eurasia, Africa, and America, lecturing in the United States and Canada in 1890. Among her principal novels are "In the Days of My Youth," "Half a Million of Money," "Hand and Glove," and "Lord Brackenbury." Her educational and historical works of interest include "A Thousand Miles Up the Nile," "Untrodden Peaks and Unfrequented Valleys," "Pharaohs, Fellahs and Explorers," and "Manual of Egyptian Archaeology."

EDWARDS, Jonathan, philosopher and theologian, born in East Windsor, Conn., Oct. 5, 1703; died March 22, 1758. After securing an elementary education, he entered Yale College, where he graduated in 1720. Subsequently he became tutor at Yale and after a few years was ordained pastor at Northampton, Mass., where he remained until 1750. From 1751 until 1758 he preached as a missionary to the Housatonic Indians at Stockbridge, Mass., after which he succeeded his son-in-law, Aaron Burr, as president of Princeton College. His influence in the thought and life of New England was very marked, and as an original investigator of philosophy he still ranks among the most eminent



JONATHAN EDWARDS.

of America. His personal character was one of refinement and generosity, while in theology he ranked as a rigid Calvinist. He published his famous "Inquiry into the Freedom of the Will" in 1754, which is still regarded as one of the most able productions on the subject of mental science.

EDWY, King of England, son of Edmund I., born about 918; died Oct. 1, 959. He succeeded his uncle Edred in 955. His reign became unpopular because of his opposition to the monasteries, on account of which Saint Dunstan led the papal party in opposition and drove him from the throne of Mercia and Northumberland in 957. He was succeeded by his brother Edgar.

EEL, the name of a class of serpent-shaped fishes found in nearly all rivers and seas of the warmer zones. About fifty species have been described, differing somewhat in form, but all are covered by a soft, thick, slimy skin, some having minute cycloid scales. The gill orifices are very small and are situated far back, by reason of which they can remain out of water a long time. Some species frequent the land by night in search of food. Eels prefer to live in the mud, and in cold weather bury themselves in the muddy bottom or migrate to warm and sluggish waters. They are very sensitive to cold and not found in latitudes beyond 64° 30′ north or south of the Equator. They are particularly abundant near the deltas and estuaries of rivers, where the adults spawn, and in the spring immense numbers of young eels pass up streams and canals, overcoming many obstacles in their progress. They are excellent and nutritious food. The *electric eel* found in the marshy waters of the llanos in South America attains the length of four or five feet and discharges a perceptible current of electricity when it is touched.

EGAN, Maurice Francis, scholar and author, born in Philadelphia, Pa., May 24, 1852; died Jan. 15, 1924. He was trained to fit him for a literary career, having graduated at La Salle College and Georgetown University. He studied law, but soon after engaged in journalism by editing *McGee's Illustrated Weekly.* His observations in extended trips through the southern and western states and Mexico were embodied in letters and articles to magazines. Soon after he became editor of the *Catholic Review.* In 1881 he took charge editorially of the *Freeman's Journal* and in the meantime contributed various articles to "Appleton's Cyclopaedia." For several years he was professor of English literature at Notre Dame University, Indiana, and afterward instructed in the Catholic University of America at Washington, D. C. Among his educational publications are "Essays on English Literature," "Theater and Christian Parents," "Glories of the Catholic Church," "Best Literature of the World," and "Modern Novels and Novelists." Among his novels are "That Girl of Mine," "That Lover of Mine," and "Jack Chumleigh."

EGBERT (ĕg′bĕrt), King of Wessex, considered the first king of the united Anglo-Saxons, born about 775; died in 836. When he succeeded to the throne of Wessex in 802, England was divided into the three kingdoms of Mercia, Northumbria, and Wessex, but after a struggle he made all England dependent on him and was recognized overlord, both of Mercia and Northumbria. He was succeeded by Ethelwulf.

EGG, the cell or ovum and its accompanying products which are extruded from the ovary of females of various animals, containing the germ, origin, or first principle of life. It consists essentially of a single cell of protoplasm, in which rests the potentiality of life of an individual corresponding to the parent stock, but rarely two or more such cells are contained in the egg, when the life product is a deformity or results in more than one offspring. Reproduction in all animals is by eggs, except in the Protozoa, but in some animals the egg is incubated within the body and the new life is brought forth in a more or less immature state. Young produced in this way are said to be *born,* while those developed from eggs outside of the body are said to result from hatching or incubating.

In general the term *egg* is used only in connection with animals that do not produce their young alive, in other words, the oviparous animals. The most common oviparous animals include birds, reptiles, fishes, insects, and worms. Eggs usually contain, besides the germ, substances which serve for nourishment of the new life. In animals below the birds, the egg has only three parts, the germ, the germinal vesicle, and the yolk. In the egg of birds, besides these, are a calcareous shell, a tough skin, and a considerable amount of white or albumen. When the young animal is developing, it is nourished first by the albumen and then by the yolk, both of which are consumed before it comes out of the shell.

The eggs of birds and fowls are usually oval, but a few are nearly round. In one end of the egg, between the skin and the albumen, is an air cavity which is thought to facilitate the breathing in the early stages of the new life. The outer covering of the eggs of reptiles and lizards consists of a parchmentlike membrane, while in cartilaginous fishes, such as sharks and rays, the egg is inclosed in a four-sided horny case, with tendrils projecting by which it is moored to floating seaweeds. These, after the escape of the young fish, are washed upon the shores, where they are familiarly known as *mermaid's purses.* Eggs of animals now extinct have been found in Madagascar three feet in circumference, but the ostrich lays the largest egg of any animal now living.

The eggs of birds and fowls are hatched by being kept at a temperature of about 104° Fahr. for a period of from two to four weeks. Crocodiles, alligators, and turtles bury their eggs in the sand, where they are incubated by the heat of the sun or by the warmth of decaying vegetation. Eggs of the turtle are in repute as an article of food and luxury, and those of gulls, guillemots, and wild ducks are much sought by the inhabitants of the Orkney and Shetland islands, as well as Iceland and other northern regions. On the coast of Labrador an extensive business has developed by the eggers, who collect the eggs of sea birds and carry them to the markets of Canada and the United States. Tremendous precipices are braved by men, whom their companions let down by means of ropes to gather the eggs from ledges.

Birds differ greatly in the number of eggs which they lay for a *set* or *clutch*, but in this respect the individuals of the same species are quite uniform. The larger birds of prey and many waterfowl lay only one egg in the year, while others, as the hen, produce a large number. Field and woodland birds, as the robin and crow, usually lay from five to seven, while the titmouse ordinarily deposits about ten. In some instances the color is quite similar to that of the nests, but it includes white, brown, greenish, and variously spotted species. The egg of the hen is the most important as a commercial product. It consists of 73.7 parts water, 13.4 parts protein, and 10.5 parts fat. Other eggs sold on the market are those of the duck, turkey, goose, and guinea. Besides being valuable as food, eggs are used for purifying liquids and the albumen is useful in preparing photographic paper. See **Evolution; Nest; Poultry.**

EGGLESTON (ĕg'g'lz-tŭn), **Edward,** author and historian, born in Vevay, Ind., Dec. 10, 1837; died Sept. 3, 1902. His education included a knowledge of French, Latin, and Greek, and he became acquainted with the literature of these languages and of the German, Spanish, and Italian. He entered the Methodist ministry in 1856, and subsequently held pastorates in the Minnesota cities of Saint Peters, Saint Paul, Stillwater, and Winona. In 1866 he became associated with the editorial work on the *Little Corporal,* a publication for children issued at Evanston, Ill., and subsequently edited successively the Chicago *Sunday School Teacher,* New York *Independent,* and *Hearth and Home.* He was pastor of the Church of the Christian Endeavor, Brooklyn, from 1874 to 1879. His novels and historical publications portray a deep power of thought and are read extensively. Among them may be named "The Hoosier School Master," "The Circuit Rider," "The Hoosier School Boy," "The Faith Doctor," "Eighty Famous American Indians," "The End of the World," and "School History of the United States." His most extensive production is "People's Standard History of the United States," a work published in six volumes.

EGGLESTON, George Cary, writer, brother of Edward Eggleston, born in Vevay, Ind., Nov. 26, 1839. He studied at Indiana Asbury University and Richmond College, Virginia, and soon after began the practice of law. Shortly after the beginning of the Civil War, he volunteered and served in the Confederate army, and after the war engaged in journalism in New York. Subsequently he became editor in chief of the *Hearth and Home.* In 1875 he was made literary editor of the *Evening Post* and in 1889 became editorial writer on *The World.* His books include "The Wreck of the Red Bird" "The Juggernaut" and "A Rebel's Recollections." He died April 14, 1911.

EGGPLANT (ĕg'plănt), a plant of the nightshade family, so named because the fruit resembles an egg in shape. It is native to the tropics, but may be grown in the northern portion of the United States and the southern part of Canada, when planted in a hotbed. About a dozen species are cultivated for the fruit, which is cooked in a variety of ways as a table vegetable. The species that yield a purple colored fruit is the best for general use, such as the New York purple and the black Pekin. The plant grows to a height of about two feet, has prickly leaves, and flowers of a violet color. The fruit varies from the size of a hen's egg to specimens from six to eight inches in diameter, depending upon the season and the richness of the soil.

EGINHARD (ā'gĭn-härt), or **Einhard,** the biographer of Charlemagne, born in Austrasia about 770; died March 14, 840. He became associated with the court of the emperor at an early age, was a pupil of Alcuin, and subsequently received an appointment as private secretary and superintendent of public buildings. He accompanied Charlemagne on all his journeys and marches. After the death of the emperor, he erected a monastery at Mülheim, Germany, and gave that place the more appropriate name of Seligenstadt, meaning "City of the Blessed." Among his writings are "Letters," 62 in number, and "Life of Charlemagne." The latter was completed about 820. It is well executed in plan, style, and language, and is considered the most valuable historical production of the Middle Ages. This work has had a wide translation and reading, and has been used extensively as a school text-book in the study of history.

EGMONT (âg-môn'), or **Egmond, Lamoral, Count of,** celebrated Dutch patriot, born in Hainault, Belgium, in 1522; beheaded in Brussels, June 5, 1568. He enlisted in the military service of Charles V., and in 1541 accompanied that monarch on his expedition against Algeria. Later he served with much success

(Opp. 880)

EGGS OF BIRDS.

1, 2, 3, 4, Ruffled Grouse; 5; 6, 7, 8, 9, 10, Willow Ptarmigan; 11, 12, 13, 14, 15, Rock Ptarmigan; 16, 17 White-tailed Ptarmigan; 18, 19, 20, Prairie Hen; 21, Zenaida Dove; 22, 23, White-fronted Dove; 24, Mexican Groun Dove; 25, Inca Dove; 26, Ruddy Quail Dove.

in the Battle of Saint Quentin under the banners of Philip of Spain, who appointed him governor of Flanders and Artois. He became popular with the people by forming an alliance with the Protestant party in the Netherlands against the Catholic policy of Philip. It is thought that he sought the friendship of the people rather for the sake of the common good than because of a close adherence to the Protestant religion, but writers generally describe his government as humane and virtuous. The strain of public feeling gradually intensified, and in 1565 he proceeded to Spain to adjust matters with Philip and secure a better understanding of the nature and needs of the administration. On returning to the Netherlands he became at variance with the Prince of Orange, which caused the latter to leave the country. Shortly after the Duke of Alva was sent with an army to reduce the insurgents in the Netherlands, and Egmont vainly tried for some time to gain his confidence. Later Alva seized both him and Count Horn and carried them to the citadel of Ghent. A court tribunal instituted by Alva tried them on a charge of treason and caused them to be beheaded. The people were strongly in sympathy with Egmont, demonstrating much feeling on account of his death, and regarded him a martyr in the cause of freedom. Goethe made Egmont a hero in one of his dramas.

EGOISM (ē'gō-ĭz'm), the doctrine of a class of philosophers, according to which a person can be certain of nothing but his own existence, and that of the operations and ideas of his own mind. As affecting mental sensations, egoists involuntarily regard the body as ego, that is, the being itself; but, so far as cognition is concerned, the body is regarded objective, or non-ego. Egoism, in an ethical sense, is now used as an antonym to altruism (q. v.).

EGRET (ē'grĕt), the name of several species of heron, especially those that have a well-developed crest during the breeding season, and whose back is adorned with long, loose flowing plumes. The American egret is about 37 inches long, measured from the tip of the beak to the end of the tail, and the extent of the wings is 55 inches. The snowy egret, native to the region bordering on the Gulf of Mexico, is a beautiful bird. It is hunted for the sake of the plumes during the breeding season, hence is becoming rapidly exterminated. The reddish egret is remarkable in that some birds of the same species are nearly white while others have a bluish-slate color, and it appears that the differences in color are not dependent upon sex, age, or season. Several species are native to Europe and Asia, including the European and the white heron.

EGYPT (ē'jĭpt), a country of Africa, situated between the Red Sea and the Libyan Desert, and extending from the Mediterranean Sea to the Nubian Desert. It is bounded on the north by the Mediterranean Sea, on the east by Syria and the Red Sea, on the south by a line drawn from the Red Sea to a point about 200 miles west of Wadi Halfa, and on the west by a line drawn from about 200 miles west of Wadi Halfa to the southeastern point of Tripoli, and thence north to the Mediterranean.

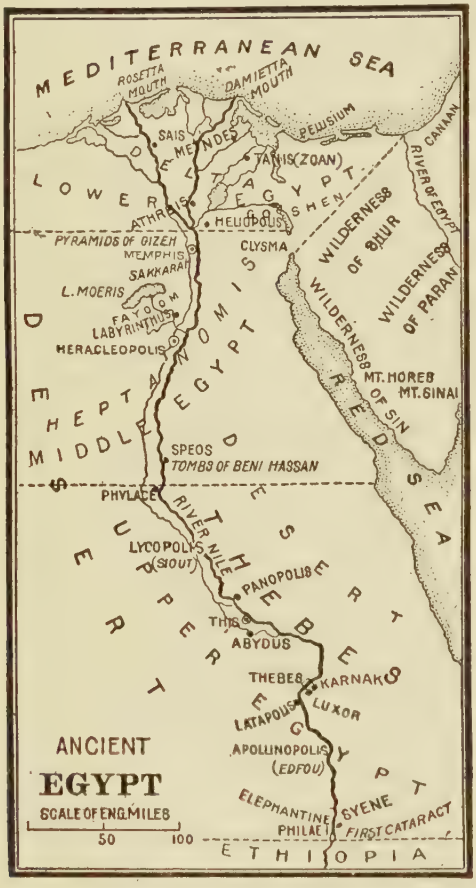
SNOWY EGRET. LITTLE EGRET.

The southern boundary coincides nearly with the latitude of 22° north. It includes the eastern third of the Libyan Desert. The extent from east to west is about 500 miles and the length north and south is 670 miles. The area of Egypt proper is 394,240 square miles.

DESCRIPTION. Most of the surface consists of a sandy desert, the cultivated portion being confined to the country more or less affected by the annual inundations of the Nile and the coast plains along the Mediterranean. This fertile region includes only about 10,000 square miles, and contains almost the entire population of the country. The Nile flows through it from south to north, though it has no tributaries within Egypt, owing to the arid condition of the country. West of the Nile are the barren wastes of the Libyan Desert, much of which is elevated only a few hundred feet above the sea, while many small localities are below it and derive their water by infiltration from the Nile. In the eastern part is a region of mountains, extending from Assuan and Berenice in the south to Cairo and Suez in the north. The mountains cover a district about 150 miles wide and are highest near the Red Sea, where their summits approximate 7,000 feet. The country south of Assuan is made up largely of sand plains and desert hills, which form the northern part of the Nubian Desert.

The course of the Nile through Egypt is about 800 miles. A short distance south of Assuan is the First Cataract, the only one in

Egypt, where a great dam is maintained to regulate the supply of water for irrigating purposes. The annual overflow of the Nile has a tendency to fertilize the soil and render it exceedingly productive. Usually the overflow begins the middle of July and is occasioned by excessive falls of rain in the mountains and lake region near the Equator. The irrigated land begins to dry in October and the crops are sown in November, maturing in March, when they are harvested. Southwest of Cairo is a fertile tract, the depressed valley of Fayum, and near its northern extremity is the lake of Birket-el-Kerun. Many of the localities ad-



jacent to the Nile and some of its banks are characterized by masses of rock and broken cliffs. Extensive forests are entirely unknown in the upper valley, but small clusters of trees are found in some localities.

The atmosphere is dry and the sky is clear most of the year. At Cairo the rainfall is less than two inches per year, while at Alexandria, on the coast, it is about eight inches. Near the sea the temperature rarely reaches the freezing point, but the thermometer sometimes registers 114°. In April and May a large part of the country is visited by the khamsin winds, which cause a rapid rise of the temperature and fill the air with dust and sand. The sycamore is the prevailing tree and is rivaled only by the date palm. Many species of trees have been introduced and are cultivated in the regions where moisture is sufficient. The lotus and the durra, the almost extinct papyrus, are Egyptian plants. Fish are abundant in the Nile and off the coasts, and birds and insects are numerous. The fox, jackal, wild ass, leopard, lion, and striped hyena are among the wild animals.

Agriculture. About two-thirds of the people are engaged in agricultural pursuits. Three crops are grown annually in the districts that are well irrigated, this being possible on account of the large amount of organic matter deposited by the waters of the Nile. Clover, wheat, barley, and vegetables grow best from December to March; sugar cane, rice, cotton, millet, and fruit thrive from April to July. The Nile Delta is the richest region and produces most abundantly. Among the tropical fruits are the orange, lemon, and fig, and the grape, pomegranate, apple, plum, and quince thrive in nearly all parts where moisture is sufficient. Raw silk is produced to some extent and tobacco can be grown profitably, but its cultivation is not permitted. The live stock industry is on a profitable basis, and especial attention is given to the rearing of sheep, cattle, and camels. Swine are raised by the Copts, and horses and mules are quite common in the cities.

Mining. Egypt is not rich in mineral wealth, though it is possible that deposits exist which have not been discovered. Gold mines were worked anciently in the rugged mountains of eastern Egypt and some of them have been rediscovered. Salt is obtained in the salt marshes of the Nile Delta and considerable saltpeter is manufactured. Vast deposits of limestone, granite, and sandstone were worked in ancient times, but comparatively little is done in this line at present. The material used in the construction of the great pyramids and many temples was obtained from the granite deposits near Syene, where the supply is inexhaustible.

Transportation and Commerce. Alexandria is the chief seat of foreign commerce, being favored by its location on the Mediterranean and a number of important railways. A large trade is carried on at Cairo and other points on the Nile and the Suez Canal. Inland trade is chiefly by caravans, by railways, and by transportation on the Nile, which is navigable the entire distance in Egypt. Many of the highways have been improved and are being maintained by local taxes. The country has 2,500 miles of railways, most of which are owned by the government. The Cape-to-Cairo Railroad is the most important line and will furnish transportation facilities to Cape Town. Tele-

phones are utilized in the cities and many rural districts, and all of the principal trade centers have telegraph communications. Great Britain has the largest share of foreign trade, and next in order are Turkey, France, Germany, Austria, Italy, and the United States.

The weaving of fez and linen is an ancient industry, but modern customs in dress have caused it to decline. Sugar is manufactured quite extensively by the employment of foreign capital, and Egypt is an exporter of that product. Other manufactures include cotton and woolen goods, cigarettes, clothing, utensils and machinery of different kinds. Cotton, cotton seed, meat, hides, and fruit are the chief exports, while coal, wood, textiles, and metal products are imported.

GOVERNMENT. The government is an independent monarchy, recognized as such in 1922, and the chief executive is the king, at present Fuad I. He is assisted by six ministers in the administration of government, those of justice, interior, finance, war, foreign affairs, and public works and public instruction. France formerly exercised the greatest influence politically, but after the rebellion of Arabi Pasha the predominant influence passed to England and the public defenses were under the control of that country. The country now is entirely free from European influence. Improvements have been going forward and trade relations have been enlarged materially within the last two years. The legislative power is vested jointly in the legislative council and the general assembly. Local government is administered by six governorships and fourteen provinces.

INHABITANTS. Native Egyptians comprise the greater part of the inhabitants, but a majority of these are known as fellahs, who comprise the lower class. The people in the smaller towns are wholly Egyptians, while the larger cities contain many foreigners. Among the foreign inhabitants are the Arabs, Greeks, Italians, British, French, Germans, and Persians. Nearly all of the Mohammedans are of the Sunnite faith, constituting about 92 per cent. of the entire population. Next in order of number are the Christians, chiefly Copts, and Jews. Cairo, the capital, is located on the Nile in lower Egypt. Alexandria is on the Mediterranean and Port Said is the chief town on the Suez Canal. Other cities include Rosetta, Damietta, Suez, Tanta, Assiut, Gizeh, and Mansourah. The total population in 1922 was 13,990,593, which included 111,680 foreigners.

LANGUAGE AND LITERATURE. Comparatively little is known in regard to the origin of the language spoken by the ancient Egyptians. It showed some affinity to the Semitic languages, but as a whole was quite distinct in its general construction. The history of the language is divided usually into four periods, including those in which prevailed the four systems of writing known as the hieroglyphic, hieratic, demotic, and Coptic. It is not known when the *hieroglyphic* system of writing originated, but there is an abundance of evidence that it prevailed extensively as early as 3000 B. C. The *hieratic* writings are those of the priests or sacerdotal class, while the *demotic,* a popular form of hieratic writing, came into literary use about the 7th century B. C. Greek letters were used frequently to write demotic words and later Semitic forms came to be added, thus giving rise to the *Coptic* language, the latest form of the Egyptian. At present it is employed only in the liturgy of the Coptic Church, and in its stead the Arabic is now in common use.

Though the Egyptian language underwent marked changes, there is a notable similarity in the literature of the different periods. In the epoch of history included in the reign of the Rameses inventive genius was especially encouraged, particularly such talent as led to the production of novels and works of amusement. However, by far the most important writings are of a historical character, especially in the time of the Ptolemies, when the lore of the East was energized by western scholars, particularly by the Greeks. The works in religion are numerous, especially in the Coptic period, when church rituals, homilies, and other Christian literature were introduced.

Among the Egyptian writings is an interesting work entitled "Book of the Dead," a copy of which was found in a tomb of a queen of the 11th dynasty, which is thought to date from about 3000 B. C. It contains an account of the adventures of the soul after death, and gives directions by which it is possible to reach the hall of Osiris. The writings on astrology, moral philosophy, agriculture, medicine, physics, economics, ethics, mathematics, and poetry are numerous. A work on geometry, entitled "The Principle of Arriving at the Knowledge of Quantities," dates from about 1100 B. C. Euclid, the Greek mathematician, who flourished at Alexandria about 300 B. C., gave impetus to mathematical research and wrote his "Elements of Geometry," a work still recognized as authoritative. "The Romance of Setna," written about the 3d century B. C., and "The Tale of Two Brothers," probably written about the time of the exodus, are two works in story form. Many writings are in the form of epistolary letters and epic poetry. In the "Epic of Pentaur" are described the events connected with the war conducted by Rameses II. against the Kheta.

ANCIENT STATUE.

HISTORY. No country contains greater wonders of remote antiquity than Egypt. The Sphinx and pyramids are remarkable for their great size and wonderful endurance through the centuries. When Napoleon and his legions reached the vicinity of these relics, he was led to exclaim, "Soldiers, forty centuries look down upon you." The catacombs and labyrinth of Upper Egypt are likewise remarkable curiosities. The labyrinth is partly under ground, cut out of marble, and originally consisted of twelve palaces and 3,000 chambers. Anciently the Egyptians possessed a wonderful civilization, and built vast palaces, monuments, and canals. They were superior as scholars and statesmen. On many of the ancient ruins are forms of hieroglyphic writings from which we have learned much of their system of mathematics, astronomy, architecture, and religion, and of their utensils, machinery, costumes, and implements of war. Their commerce was among the most extensive of the ancient world, and their civil institutions ranked with the best. Modern Egypt is but the shadow, the ruins, of a once powerful civilization.

Egypt has a history extending back, according to different writers, to the year 3892 B. C., though some writers of profane history place its beginning about the year 5004 B. C. The priest Manetho arranged and published, in 250 B. C., a list of thirty Egyptian dynasties, and this record is still considered the best extant. In the reign of the fourth dynasty the great pyramids were built, the largest by the three kings, Cheops, Chephren, and Mykerinos—according to Lepsius, the German philologist and Egyptologist, within about the period of 2800-2700 B. C. The Pharaohs ruled the country until the Egyptians were conquered in 520 B. C. by Cambyses, King of Persia. It is thought Rameses II. was the Pharaoh who oppressed the Israelites, and that the exodus occurred in the time of his successor, Merneptah. The country was subject to Persia until Darius was vanquished by Alexander the Great, which occurred in 322 B. C.

After Alexander's time Egypt passed to the Ptolemies, becoming under them and Greek influence one of the most progressive kingdoms. The Ptolemies controlled it nearly 300 years, after which it was made a Roman province and was held by them about 650 years. In 337 A. D. it became a part of the Eastern Empire, but the Romans were finally expelled by the Saracens under Caliph Omar in 640 A. D. The last dynasty of the Saracens was overthrown by the Mamelukes in 1250, who held the supreme power more than two centuries, but they were subjugated by the Turks in 1517 under Selim I., the Ottoman Sultan.

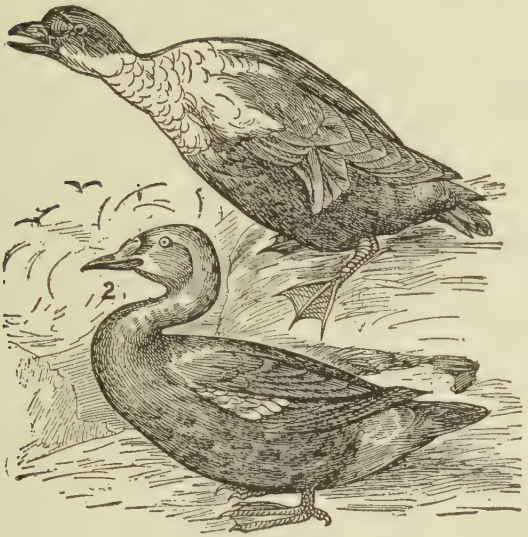
Napoleon I. conquered Egypt for France in 1798, though his army was driven out by the British and the country returned to Turkish rule in 1801. Mohammed Ali became pasha in 1805, after completely vanquishing the Mameluke chiefs, and introduced the elements of European civilization. He was succeeded by Said Pasha, during whose reign the French engineer, M. de Lesseps, commenced the Suez Canal, which was opened in 1869. Within recent years both the French and the English have sought to enlarge their influence in Egypt. The latter under General Kitchener defeated the dervishes in the Battle of Omdurman in 1898, while Fashoda was occupied by the French, on account of which complications arose between the two nations, but all differences were settled by arbitration on Jan. 9, 1899. The terms of the treaty place a portion of the Egyptian Sudan district under the English and a portion under the French. The British declared a protectorate over Egypt in 1914, shortly after the Great European War began, but the protectorate was declared at an end by the British in 1922, giving the country a new independence.

EGYPTOLOGY (ē-jĭp-tŏl'ō-jy), the study of Egyptian antiquities. The object of this branch of learning is to investigate the early life, language, customs, and achievements of the people of ancient Egypt. The study was induced largely by the discovery of the famous Rosetta stone by M. Boussard, a captain of Napoleon's army, in 1799. This stone contains a proclamation written in hieroglyphics, and is the key by which many of the inscriptions on Egyptian monuments may be deciphered ultimately. In 1883 a society was formed to explore the ancient temples and tombs, its object being to make historical investigations for the purpose of endeavoring to ascertain the history of the sojourn and exodus of the Israelites. The society has been able to enrich many of the museums of Europe and America with valuable specimens, and several works have been published in which descriptions and maps are given of many important ruins and relics of the Nile between Assuan and Cairo.

EHRENBREITSTEIN (ā-rẹn-brīt'stīn), a town and important fortress of Rhenish Prussia, Germany, situated opposite the confluence of the Moselle with the Rhine, and connected with Coblenz by a railroad viaduct and a pontoon bridge. It is built on a precipitous rock 387 feet above the river and is inaccessible from three sides. The fortifications were begun in the latter part of the 17th century, but were destroyed by the French. They were rebuilt in 1816-26 at a cost of $6,000,000. The fortress has ample accommodation for 14,000 men and capacity for storing provisions sufficient to maintain an army of 60,000 for a year. The town is unimportant and has a population of 6,500.

EIDER DUCK (ī'dẽr), a species of duck which is nearly twice the size of the common duck. It inhabits the rocky shores and islands of America and Europe. The male is black and white spotted, while the female has reddish-drab colors mixed with black, and white bands

on the wings. This species of aquatic birds subsists on insects, shellfish, small fish, and tender shoots of plants. The *king eider* is an



KING EIDER; 2, EIDER DUCK.

allied species, resembles the eider duck, and inhabits the same regions.

EIFFEL (ĕf-fĕl′), **Gustave,** noted engineer, born in Dijon, France, Dec. 13, 1832. After securing a general education, he studied at the Paris Central School of Arts and Manufactures, and first attracted attention by using the compressed air method of sinking foundation cylinders in the construction of the Bordeaux bridge. Soon after he erected the Garabit viaduct, the framework of Bartholdi's statue of "Liberty Enlightening the World," and numerous other works requiring more than ordinary skill. His greatest engineering enterprise was the construction of the Eiffel Tower, on the Champ-de-Mars, in Paris, which was completed March 31, 1889, for the Paris Exposition. The total height of the tower is 984 feet and the weight of iron used in its construction aggregates 7,325 tons. At a point 896 feet above the surface it has a diameter of 33 feet. Persons may be carried to the top by a system of elevators. He died Dec. 28, 1923.

EIGHT-HOUR DAY, the term applied to what has been proposed as the ideal working day by trade and labor unions.

EINSTEIN THEORY, the doctrine of relativity as applied to astronomical phenomena. This theory was announced in 1919 by Albert Einstein, a German astronomer of Jewish parentage, born at Ulm, Germany, in 1879. He studied at Munich and Zurich and in 1913 was admitted to the Academy of Sciences at Berlin, through which he became well known internationally.

The Einstein Theory is based upon the doctrine that things can be known only through relations, that our knowledge of the universe depends more or less upon information acquired by ascertaining what relation or interdependence two or more things have upon each other. Vision being a primary factor in securing knowledge of the universe outside the earth, hence light is not only necessary but the properties and characteristics of light are fundamental elements in the study of celestial phenomena. According to this theory, "time" and "space" could not exist if the universe had no contents, such as the earth, sun, and other heavenly bodies, differing from the former view that space and time exist by themselves without regard to the contents of the universe.

Formerly astronomers assumed that ether fills all space and yet is absolutely stationary, but this theory was disproven by Albert A. Michelson (q. v.) in 1909, who discovered that some influence exists which renders it impossible to detect the rate and direction of the motion of the earth through the ether. Michelson also demonstrated that there is no absolute motion, the velocity of light being the greatest known, which in a vacuum uniformly is 186,330 miles per second, and all other motion in a straight line is purely relative. From these observations of Michelson, Einstein proceeded to show that the laws of motion and gravitation announced by Sir Isaac Newton hold good only for moderate velocities. In the consideration of high velocities he applied the theory of electrons, according to which mass is identical with latent energy, and the mass of the body varies with its velocity. This variation is assumed to equal the square of the ratio of the velocity of the body to the square of the velocity of light. The velocity of light, therefore, is considered a fundamental relation between time and space. The general theory of relativity, in addition to the three well-known dimensions of space, namely length, breadth, and thickness, assumes the importance of time, hence time is called the fourth dimension of reality.

EISENACH (ī′sẹn-äk), a city of Saxe-Weimar, Germany, situated on the northwestern limit of the Thuringian Forest. It is celebrated on account of the castle of Wartburg, which was built in 1067 on an elevation 600 feet above the site of the city. Luther occupied the castle as an asylum for ten months, in 1521-22, in accordance with the wishes of the elector of Saxony, remaining there for nearly a year after May, 1521. Visitors are still shown the chapel in which Luther preached, the chamber he occupied, and the point struck by the inkstand thrown at the head of the Evil One. Population, 1921, 35,153.

EISLEBEN (īs′lā-bẹn), a city of Prussian Saxony, Germany, about 25 miles northwest of Merseburg. It is celebrated as the place where Luther was born and where he died. The city contains numerous memorials of Luther, a fine

bronze statue erected to his honor in 1883, and the house in which he was born, the latter having been consumed partly by fire, though it is still preserved with studious care. The noteworthy buildings include the Church of Saint Andrew, in which are many memorials of Luther and Melanchthon. Eisleben has railway and electric railway facilities and considerable trade. Copper is mined in the vicinity. It has belonged to Prussia since 1815. Population, 1926, 25,121.

EKATERINBURG (yĕ-kà-tyĕ-rĕn-bo͝ork′), a fortified city of Russia, in the province of Perm, 180 miles southeast of Perm. It is located on the Isset River, near the eastern slope of the Ural Mountains, and is surrounded by a productive mining region. The trade is chiefly in iron, cattle, tallow, and cereals. A branch connects it with Cheliabinsk, on the Trans-Siberian Railway, giving it good transportation facilities. It has a public museum of mineralogy, a government mint, a chemical laboratory, and a number of schools and churches. The public utilities include electric lights, waterworks, and electric railways. Peter the Great founded the city in 1722 and it was named after Catherine I., Empress of Russia. Population, 1922, 62,503.

EKATERINODAR (yĕ-kà-tyĕ-rĕ-na-dăr′), a city of Russia, capital of the Kuban territory, 950 miles south of Moscow. It is located on the Kuban River, about 100 miles from its mouth, and is surrounded by a low and swampy region. The streets are regularly platted, but are not well improved by draining and sewerage. The chief buildings include a cathedral, a museum of natural history, and several government buildings. It has a considerable trade in cattle and cereals and is the seat of annual fairs. Cossacks founded the city in 1794 and named it in honor of Catherine II. Population, 1906, 68,704; in 1921, 157,023.

ELAM (ē′lăm), an ancient country of Asia, known by the Greeks as Susiana and Cissia. It comprised the great plain east of the lower Tigris and included the Zagros and Pushti mountains. The country formed a part of the ancient Persian Empire. Susa or Shushan was its chief city. It appears from the cuneiform inscriptions that Babylon and Assyria were conquered by a king of Elam about 230 B. C., but the Babylonians subsequently captured Susa. In 694 the Elamites overran Assyria and humiliated Sennacherib, and many of the Assyrians were carried away in captivity. Elam was conquered and Susa was razed to the ground in 642 B. C., when many of their valuable books and images were carried away to Nineveh.

ELAND (ē′lạnd), a species of antelope found in South Africa. Livingstone speaks of it as the most magnificent of all antelopes. It more nearly resembles cattle than other species of antelopes, having a broader muzzle, heavier limbs, and a greater bulkiness of form than the common antelope. The height at the shoulders is about five feet and the weight is from 700 to 900 pounds. The horns are two feet long, extending backward and outward, and the face has a gentle and ovine expression. Large herds formerly frequented the fertile hills and

ELAND.

low plains, but European settlements have diminished very materially their numbers. They are hunted for their flesh and hide, both being highly esteemed in the market.

ELASTICITY (ē-lăs-tĭc′ĭ-tў), that property of matter by which it resists change of shape, and returns to its original form when the distorting force is withdrawn. If a body completely recovers its original volume the instant the stress is removed, its elasticity is perfect. Air and all gases as well as water and all liquids are perfectly elastic. Solids do not act this way, and their elasticity of shape is not perfect. For example, glass might be expected to be perfect, but experience proves that it is not, showing a notable degree of imperfection in the torsional elasticity of glass fibers. On the contrary, in copper, brass, soft iron, steel, and platinum, providing the distortion does not exceed a certain limit, the elasticity of shape is much more perfect than in glass. If the strain is too great, the body either breaks or receives a permanent bend. The elasticity of water was proved by John Canton (1718-1772) in 1762. Elasticity in gases is measured usually by the height of a column of mercury they sustain. The term *compressibility* is used frequently in connection with elasticity of volume, and *rigidity* is employed in reference to the change of shape.

ELBA (ĕl′bà), an island belonging to Italy, situated in the Mediterranean, six miles from the mainland, and separated from it by the Strait of Piombino. It is eighteen miles long and varies from three to eleven miles in breadth. It is traversed by a mountain range, the highest elevation being 3,500 feet above the sea level. The coast is rugged and precipitous, the mountains are bare, and the valleys and lowlands produce fruit, wheat, Indian corn, vegetables, and watermelons. Domestic animals common to the continent abound. Iron of

an excellent quality, associated with granite and marble, forms a mountain two miles in circumference and 500 feet high. The island is famous in history for having been Napoleon's place of exile from May 4, 1814, till Feb. 26, 1815. Porto Ferrajo is the capital. Population, 1922, 24,515.

ELBE (ĕl'bę), an important river of Europe, rises in the Riesengebirge of northern Bohemia, near the frontier of Prussian Silesia. It is navigable for seagoing vessels from its mouth to Hamburg, about 85 miles, and for smaller vessels a distance of 525 miles. The total length is 725 miles. An extensive system of canals connects it with numerous points of commercial interest. Among its principal tributaries are the Havel, Mulde, Moldau, Saale, and Eger. The general course through Germany is northwest and the mouth is at Cuxhaven, where its waters flow into the North Sea. Its extensive estuary is obstructed by numerous shoals and islands. It ranks as an important waterway and is rich in valuable fish. Since July 1, 1870, the navigation has been free to commerce from Melnik, Bohemia, to Hamburg.

ELBERFELD (ĕl-bĕr-fĕlt'), a city in Rhenisn Prussia, Germany, about fifteen miles east of Düsseldorf, on the Wupper, a small tributary of the Rhine. It ranks as one of the leading commercial centers of the empire, owing to its extensive trade and manufactures, and has communication by electric and steam railway lines. Among the noteworthy buildings are the courthouse, the city hall, the public library, and the normal school. It has a fine public park and many monuments dedicated to prominent men. The manufactures include clothing, machinery, paper, ironware, and cotton, woolen, and silk goods. Large exportations of ribbons, tape, buttons, laces, carpets, and musical instruments are made. Among its numerous dyeworks are the celebrated Turkey red, which has given the city a reputation in the markets of the world. The city is a center of much wealth and has many modern improvements. Population, 1905, 162,853; in 1920, 170,118.

ELBING (ĕl'bĭng), a seaport city of West Prussia, Germany, on the Elbing River, near its confluence with the Frisches Haff. It is connected with the Nogat by a canal, has good railroad facilities, and is the focus of several interurban railways. Among its noted buildings are the city hall, the gymnasium, and the public library of 35,000 volumes. The manufactures consist chiefly of cotton, linen, and woolen goods, soap, leather, clothing, beverages, and machinery. It is the seat of the Schichau shipbuilding works. Elbing dates from the 13th century and was long an important member of the Hanseatic League. It has belonged to Prussia since 1772. Population, 1920, 58,631.

ELBURZ (ĕl'bo͝orz), a mountain range of northern Persia, trending parallel to the southern coast of the Caspian Sea. The average height of the peaks is from 5,000 to 8,000 feet, while the culminating peak, Mount Demavend, is 18,600 feet. Mount Demavend is a famous volcano. A short distance southwest of it is Teheran, the capital of Persia.

EL CANEY (ĕl kä'nā-ē), **Battle of,** an engagement of the Spanish-American War, which occurred on July 1, 1898. The Spaniards had a force of 520 men at the town of El Caney, about four miles from Santiago de Cuba, and were commanded by Gen. Vara del Rey. General Lawton with 4,500 Americans made the attack and met with desperate resistance, but the Spaniards were defeated. The Americans lost 423 men and the Spaniards lost about 400, including 100 prisoners.

ELDER (ĕl'dĕr), a large shrub or tree found in both hemispheres, including several species. Most species have pinnate leaves and a small creamy-white flower, which clusters in terminal cymes, usually appearing in June. The berries are nearly black and are used to make a kind of wine. They are considered wholesome food, especially in the form of pies and jellies. The wood of the tree is yellowish, takes a fine polish, and is used in making mathematical instruments. Young shoots of the elder have a very large pith, which, when pushed out with a rod, leaves a hollow cylinder and in this form are used by boys in making popguns. The pith, being very light, is employed for various electrical experiments.

ELDON (ĕl'dŭn), **Baron,** statesman, sometimes spoken of as John Scott, born in Newcastle, England, June 4, 1751; died Jan. 13, 1838. He descended from respectable parents, was educated in the Newcastle grammar school and at Oxford University, after which he studied law and attained much success as an advocate. In 1783 he entered the House of Commons and was knighted. He was appointed solicitor-general in 1788 and five years later was made attorney-general. In 1799 he became chief justice of the court of common pleas, subsequently entered the House of Lords as Baron Eldon, and soon after became lord chancellor, which position he held for nearly 26 years. George IV. raised him to the dignity of an earl in 1821. He is mentioned as a man of prepossessing appearance, winning manners, and a supporter of Tory principles. The accuracy with which his name is often associated it due largely to the time required by him to make a decision, his critics often charging that the delay taken for consideration proved of greater harm than an adverse judgment could possibly be. As a reformer he is of little note, while his ardent opposition to certain religious works often caused delays and dissatisfaction. During his long period of office he amassed a fortune estimated at fully $2,500,000.

EL DORADO (ĕl dō-rä'dō), meaning the golden or gilded land, a term used by the Spanish conquerors of America to describe a coun-

try which they imagined to exist. Their vivid imaginations were stimulated largely by the successes in Mexico and stories told them by natives. Among the incidents of interest is the one connected with the vain attempt of Ponce de Leon to find a spring in the new world that would confer perpetual youth upon all who partook of its waters. Another is the story of fabulous riches reported by Orellana, a Spanish officer of Pizarro, after sailing down the Amazon in 1540. These stories inspired many Spaniards to enter upon voyages, and thereby stimulated the discoveries and settlements of many regions. Sir Walter Raleigh imitated the Spaniards by twice visiting Guiana in search of fabulous riches. El Dorado is the poetic name applied to a country which Orellana pretended he had discovered between the Orinoco and Amazon rivers. To this region he attached accounts of immense quantities of precious metals that he claimed to have discovered, and vividly described a city called Manoa, which he represented as the capital of that country.

ELDORADO, a city of Kansas, county seat of Butler County, 135 miles southwest of Topeka, on the Santa Fé and the Missouri Pacific railroads. It is situated on the Walnut River and is surrounded by a fertile farming and oil-producing country. The industries include flour mills, oil refineries, limestone quarries, and machine shops. It has electric lights, a number of fine schools, and several county buildings. The first settlement on its side was made in 1858 and it was incorporated in 1870. Population, 1904, 3,635; in 1925, 9,500.

ELECAMPANE (ĕl-ē-kăm-pān′), a plant closely allied to the aster, native to Europe, and naturalized in various parts of North America. It attains a height of three or four feet, has root leaves about two feet long, and bears large yellow flowers. The root has an agreeable aromatic odor when dried, somewhat like that of camphor, and is used in medicine as a tonic and stimulant, especially in chronic diseases of the lungs. Several species are cultivated in gardens for their orange-colored flowers.

ELECTION (ē-lĕk′shŭn), the act or proceeding of selecting a person or persons for office, especially if done at a meeting in which the voting is by ballot. In the United States, Congress has power to fix the time for electing all Federal officers, except the President and Vice President. These two officers are chosen under a direct provision of the Constitution, by virtue of which the different states appoint electors under laws enacted by the legislatures of the several states. All general elections are governed by the laws of the states and electors are admitted to vote by State authority, subject to certain constitutional restrictions. In most of the states the right of suffrage is extended to any male citizen of the age of 21 years who has been a resident of the State, county, and election precinct for the period required by law, except those under sentence of imprisonment in the penitentiary and idiots. In certain states paupers are excluded. The right of suffrage has been extended in some states to women in school elections and elections to create bonded indebtedness, while in several the full right of suffrage has been accorded to them. Registration laws requiring voters to register their names and addresses a limited time before election day are in force in many states, but in some they apply only to the elections held in cities of a limited class.

The right to vote comes from the State, the power to abridge or extend voting privileges being vested in the Legislature. Naturalization as a citizen of the United States can take place only under Federal law. The right to vote at all elections has been extended to aliens who have declared their intention to become citizens in nearly half of the states, and they thus enjoy equal voting privileges with citizens of the nation. However, citizens of the United States are the only individuals who may vote in some of the states. The Federal naturalization laws provide that an alien may be naturalized only after five years' residence; this applies alike to all the nation. A limited educational qualification, such as ability to read and write, is required in a number of states, while a property qualification is provided for only in Rhode Island. The 15th amendment to the Constitution, adopted March 30, 1870, extends full suffrage to Negroes. The Australian ballot system, a favorite system of voting, has been adopted in a more or less modified form in most of the states.

In Canada the constitution provides that the government shall be similar in principle to that of the United Kingdom. The members of the House of Commons, who are the highest officers chosen directly by the people, are elected for five years, unless that body is sooner dissolved. They are dependent for their election upon the constituencies in the provinces, by which the franchises are controlled. The voting is by ballot, but the qualifications for voting at the elections vary in the several provinces.

ELECTIVE COURSES (ē-lĕk′tĭv), the term applied in American schools and colleges to the courses of study that may be chosen by undergraduate students. Formerly all students were required to pursue certain courses of study, but this plan has been supplanted in most of the institutions of higher learning. At present only a few institutions adhere absolutely to a required curriculum, and students are accorded the privilege of directing their studies along special lines or in accord with their inclination. However, the courses are divided into groups so each student must select certain studies from each group under the advice of members of the faculty. This arrangement avoids the danger of students selecting work that may be classed as one-sided, or regarded as unsuitable for the

symmetrical development of the mental faculties. Harvard University, one of the older institutions, was a leader in the movement toward establishing elective studies and elective courses. At present nearly all of the State universities are conducted on this plan, while most of the institutions where it has not been fully adopted are giving at least some choice to students in the selection of particular studies.

ELECTOR (ē-lĕk'tēr), or **Prince Elector,** the title of those princes who had the privilege of electing the Emperor of Germany. This title was established in 1256, when there were seven electors, those of Saxony, Cologne, Bohemia, Mentz, Treves, Brandenburg, and the Palatine. Later the electoral dignity was transferred from Palatine to Bavaria, but it was restored to the former in 1648, hence there were eight electors. In 1692 the number was increased to ten, but the office became obsolete on the dissolution of the Holy Roman Empire, in 1806. The term *elector* is applied to each of the persons chosen to elect the President of the United States. See **Electoral College.**

ELECTORAL COLLEGE (ē-lĕk'tēr-ăl), the body of men chosen by the people of the several states to elect the President and Vice President. The college is constituted of the entire body of electors chosen by the different states. Each State is entitled to select a number of electors equal to the whole number of members sent to both houses of Congress. Any person holding the office of Senator, Representative, or other position of trust or profit under the United States cannot serve as an elector. The first Tuesday after the first Monday in November is the day fixed by law of Congress for choosing electors. The electors of each State meet in the respective State capitals on the second Monday in January next after they are chosen for the purpose of casting their ballots for President and Vice President.

No discussion of the merits of the candidates takes place, the electors voting for the particular persons previously placed in nomination by conventions called for that purpose. This is a perversion of the intention of the authors of the Constitution, since they were originally intended to cast their votes according to their own judgment. In casting the ballots, electors are required to vote for candidates, one of whom, at least, shall not be an inhabitant of the same State with themselves. Lists of persons voted for at each capital are made, signed, and certified by the electors and transmitted to the seat of government of the United States, each list being directed to the President of the Senate. By law of Congress three certificates of all the votes given are carefully prepared, of which one is delivered in person to the president of the Senate at the seat of government, a second is sent to him by mail, and a third is delivered to the judge of the district court in the district in which the electors assemble.

At a joint meeting of both houses of Congress held on the second Wednesday of February following the reception of the certificates, the reports are opened by the president of the Senate and canvassed in the presence of both houses. The persons having the greatest number of votes for President and Vice President are declared elected, but, if no candidate has a majority, the members of the House of Representatives choose the President by ballot from the three who received the greatest number of votes in the electoral college, each State being entitled to one vote, while the Senate chooses the Vice President in a similar manner. John Q. Adams was elected President by the House of Representatives in 1828, and R. M. Johnson was chosen Vice President by the Senate in 1837.

ELECTORAL COMMISSION, a commission appointed by an act of Congress, Jan. 29, 1877, to investigate certain alleged frauds regarding the electoral votes of Oregon, Florida, Louisiana, and South Carolina in the presidential election of 1876. The appointment of a commission in relation to the election has been deemed unconstitutional by a number of able jurists. Tilden and Hayes were the respective Democratic and Republican candidates for President. The commission consisted of five representatives, five senators, and five associate judges of the Supreme Court. It was constituted of the following: George F. Edmunds, Oliver P. Morton, Frederick T. Frelinghuysen, Thomas F. Bayard, Allen G. Thurman, Henry B Payne, Eppa Hunton, Josiah G. Abbott, James A. Garfield, George F. Hoar, Nathan Clifford, William Strong, Samuel F. Miller, Stephen J. Field, and Joseph P. Bradley. Much political spirit was shown in the sessions of the commission. On February 27 the Presidency was given to Hayes by a strict party vote of eight to seven, and on March 2, 1877, the commission adjourned. The House voted to reject, the Senate to accept the findings of the commission, but on a concurrent session of both houses it was finally approved.

ELECTRIC BATTERY. See **Galvanic Battery.**

ELECTRIC CLOCK. See **Clock.**

ELECTRIC FISH (ē-lĕk'trĭk), the popular name of a fish that has the power of giving sensible shocks of electricity when touched with the hand. About fifty species of marine animals have this power. A fresh-water eel of South America is the most powerful of these animals in this respect. The body is from five to eight feet long, blackish in color, and about the same thickness throughout. Little is known in regard to its generation of electricity, but it is certain that this force is used in killing fish for food. The electric organs are intimately connected with the nervous system. The torpedo, a member of the ray family, is an electric fish found off the Atlantic coast of North America. A catfish common to the Nile, known as the raash,

is about four feet long, and gives an electric shock about equal to that of a Leyden jar.

ELECTRIC GENERATOR. See Dynamo.

ELECTRIC HEATING, a system of artificial heating by converting electricity into heat. The essential principle of an electric heater is that the temperature of a conductor which offers great resistance is raised by passing through it a current of electricity. Such a heater is made by constructing coils or circuits of some refractory metal, which are surrounded by air or some insulating material, and the heat is thrown off by means of a metallic box or radiator. When a current is passed through such a device, it heats the coils by meeting resistance, and the heat is carried off by the radiator. Another system is to pass the current through broad strips or plates of metal, which are covered by an enamel, the latter serving to carry off the heat generated, while the current passes through the metal.

By electric heating it is possible to obtain an efficiency of 80 to 87 per cent. It is used extensively in obtaining heat for housekeeping purposes, such as boiling and baking. An ordinary cooking stove in which solid fuel is used yields but two per cent. of the heat generated, since 12 per cent. is lost in obtaining the fire, 16 per cent. radiates into the room, and 70 per cent. passes out through the chimney. Electric heating is used extensively in bath rooms, street railway cars, and in many waiting rooms. It is employed largely in welding iron and steel, and many other metals which require a high temperature to unite firmly, having the advantage that no flux is required and that the surfaces do not oxidize.

ELECTRICITY (ē-lĕk-trĭs'ĭ-tȳ), the science which treats of an invisible agent producing various manifestations of energy, which is generally rendered active by some molecular disturbance, such as rupture, friction, or chemical action. The name was derived from the Greek word *elektron,* meaning amber, from the circumstance that the Greeks were acquainted with the fact that amber, when rubbed, attracts light particles, such as leaves, straw, or small pieces of wood.

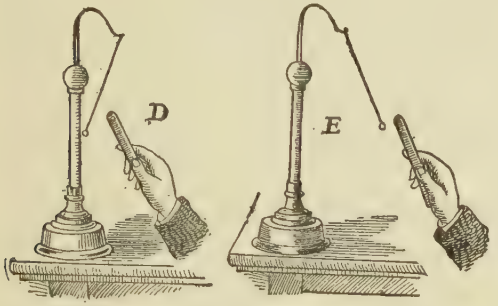
DEFINITIONS. The general science of electricity embraces a consideration of *statical* and *dynamical* electricity, or electric force in a state of rest and electric force in motion. The former is often termed *frictional* electricity, since it is usually produced by friction, but also results from greatly increasing the intensity of dynamical electricity. The latter is developed by magnetism, heat, chemical action, and other forms of energy, and exhibits its power in the form of currents. Electricity resulting from chemical action on metals is termed *voltaic,* or *galvanic,* electricity. The phenomenon of statical or frictional electricity on a simple scale may be observed by rubbing a piece of glass with dry silk, and then placing the glass near small pieces of paper or pith, which will at once be attracted to it. Similar experiments may be made with amber, rosin, gum shellac, and sealing wax.

Formerly all substances that can be electrified easily were called *electrics* and all others were termed *nonelectrics.* When the subject of *conduction* of electricity came to be investigated, it was found that the substances formerly termed electrics are *nonconductors,* and the nonelectrics are *conductors* of electricity. Since all bodies can be electrified under proper circumstances, the terms electrics and nonelectrics were abandoned as incorrect, and the terms conductors and nonconductors were adopted, this classification depending on the ability to conduct electric currents, though there are no perfect nonconductors, with the possible exception of dry gases. The term *insulator* is applied to a substance that has small conductive power, and the word *resistance* is used to express the opposition which the conducting substances forming the circuit offer to the passage of electricity. A good conductor is said to have low resistance, and a good insulator to have high resistance. The following is a partial list of substances having low and high resistance, with the best conductors and the best nonconductors named first:

CONDUCTORS.	NONCONDUCTORS.
All metals.	Shellac.
Charcoal.	Amber.
Plumbago.	Resins.
Concentrated acids.	Sulphur.
Dilute acids.	Wax.
Saline solutions.	Jet.
Spring water.	Glass.
Rain water.	Mica.
Snow.	Diamond.
Vegetables.	Ebonite.

Electricity is produced for general purposes by a conductor being rubbed on a nonconductor, as in an ordinary electrical machine having appliances to cause glass to rub against an amalgam. Two opposite kinds of electricity are manifested by substances electrified, known as *positive* and *negative,* the positive accumulating in one of the substances and the negative in the other. The presence of the same kind of electricity in different bodies causes them to repel each other, while those being charged with opposite kinds attract each other. It was long thought that electricity is a fluid, but scientists now regard it a condition of strain among the molecules of a body, a form of molecular motion, capable of being communicated like a fluid. However, nothing is known of its nature, and we are able only to understand the laws in accordance with which its phenomena are manifested. When a body is excited electrically, it is said to be *charged.* If the charge of two bodies is equal and opposite, it is neutralized by putting them in contact. When a body is charged positively, it is said to be at high potential; if charged negatively, at low potential, and when discharged, at zero potential.

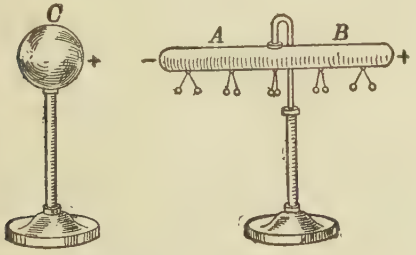
THE ELECTROSCOPE. The electroscope is an instrument used to indicate the presence of electricity, and to identify electrical charges as positive or negative. A simple electroscope consists of a pith ball hung by a fine silk fiber from a glass support. It detects the charge by moving toward or away from the charged body, as in D and E. To illustrate: If the ball be charged from ebonite, it is negative. Now bring the ball near to a body whose charge is unknown. If



SIMPLE ELECTROSCOPE.

it be attracted as in E, the charge of the latter is positive; but, if it be repelled as in D, the charge is negative.

ELECTRIFICATION. Electrical induction is the induced electrification of a body when brought near to an electrified body. The electrification is always of opposite kind to that of the inducing body on the side nearest the latter, and of the same kind on the farthest side. This may be illustrated by bringing an insulated conductor, as the cylinder AB shown in the figure, near a positively charged ball, C, fixed on a glass support, when the cylinder will acquire a negative charge at the end nearest the ball, and a positive charge at the opposite end. The pith balls attached to the cylinder will show by their



ELECTROSTATIC INDUCTION.

movement that the ends of the cylinder are excited most highly electrically, while the parts near the middle are practically neutral. All the electric charge on an insulated conductor lies on the outside of the conductor. However, this is true only of an electric charge. When the electricity is in steady motion, as an electric current, the current passes through the whole substance of a conductor.

When electrification passes from a higher to a lower potential, along a conductor, it is called an *electric current.* This occurs when any other form of energy is converted into electric energy, and two bodies, charged to different potentials, are joined together by wire. In such a case there is a sudden and complete change to equal potentials by a momentary current through the wire, and a continuous current may be maintained by applying the electrification to the two bodies as fast as it is transferred; or, in other words, there must be a constant difference in potentials. In a voltaic battery the difference of potential is maintained by an expenditure of chemical energy; in a thermo battery, by an outlay of heat energy; and in a dynamo, at the expense of mechanical energy. The force produced by changing any other form of energy to electric energy is called *electromotive force,* and the means producing it is termed the *electric source.*

While light has a velocity of 186,000 miles per second, electricity has an estimated velocity of 230,000 miles per second. However, its velocity is not definite, since it depends largely upon the source and the condition of the conductor. Practical experience has demonstrated that its velocity is greater along lines suspended on poles in the air than those laid in subterranean passages. Since the former method combines speed with economy in construction, it is commonly employed, except in cities, where a multiplication of wires is objectionable.

ELECTRICAL QUANTITIES. George Simon Ohm, a German physicist, was the discoverer of the law in accordance with which electricity flows, or passes, through a circuit, which is commonly known as Ohm's Law. This law, briefly stated, implies that the current passing through any circuit is directly proportional to the electromotive force acting on the circuit, and inversely proportional to the resistance of the circuit. In computing electrical quantities certain units are employed, which are called the *volt, ohm,* and *ampere.* The volt is the unit of electromotive force, and was so named from Alessandro Volta (1745-1827), an Italian physicist. It is about equal to the blue-stone cell. The ohm, named from Dr. Ohm, is the unit of electric resistance, and is approximately equal to the resistance offered by two miles of ordinary copper trolley wire. The ampere is the unit of electric current. It was so named from Andre Marie Ampère, and is equal to such a rate of current as will pass through a circuit whose resistance is one ohm, under an electromotive force of one volt.

USES OF ELECTRICITY. The discovery of electric phenomena and the invention of instruments and machinery to practically apply electric forces in the arts, sciences, and industries have caused a remarkable revolution in all lines of economic enterprise. Having a prolific heating effect, electricity has entered as a heating agency into homes, offices, and railway cars. It

is utilized to a large extent in electric welding. For lighting it possesses greater utility than any other form of energy, and its power to propel and move machinery exceeds the dreams of ancient philosophers. The electric spark serves in overcoming the danger formerly experienced in firing explosives, while it speeds symbols and words to all parts of the world, through the medium of the telephone and the telegraph, with the rapidity of lightning. The X-ray (q. v.) has added much of value to physical research and the practice of medicine. Among the latest electrical developments is a process for sending portraits and drawings by means of an electric current over a copper wire. This invention, called the *electrograph,* promises to be of vast value to newspaper publishers and in the detective service.

Past experience has demonstrated that water power is the most economical agent to generate electric currents, though coal, coke, gas, and mineral oil are in extensive use to produce steam for propelling electrical machinery. In many regions, as, for instance, at Niagara Falls, vast machinery is propelled by water power, and the electricity is conveyed by wire to factories at long distances. It is noteworthy that storage batteries at the places of consumption have proven highly profitable in manufacturing centers. While the use of electricity has greatly revolutionized many lines of industry and noticeably modified the arts, it is not improbable that the greatest discoveries and the most useful applications of this force are yet to be made. Certainly, it offers a vast field for study and experiments.

Historical. As early as the 6th century B. C. the Greek philosopher Thales, one of the seven wise men, wrote of the attractive force of amber when rubbed with silk, and expressed the view that amber possesses a soul. Aside from this phenomenon, nothing was known of electricity until the 16th century, when William Gilbert (1540-1603), physician to Queen Elizabeth, made some valuable experiments and published a work entitled "On the Magnet." Otto von Guericke, a German physician, the inventor of the air pump (q. v.), invented the first electrical machine about 1675. In this machine a ball of sulphur, so arranged that it turned on an axis, was electrified by friction with the hand, receiving negative electricity, while the positive flowed through the person to the earth. The Dutch writer Musschenbroek invented the Leyden jar and first exhibited it at Leyden, Holland. This invention made it possible to gather a greater quantity of electricity than ever had been produced before his time. He was not only able to discharge gunpowder by means of the current, but adapted a metallic conductor in transmitting electricity, and successfully demonstrated that the discharge along two miles of wire was practically instantaneous.

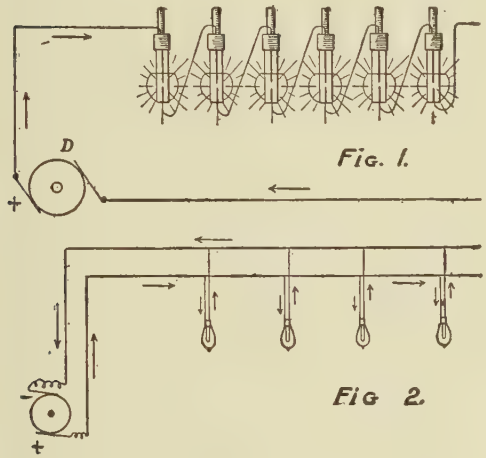
Benjamin Franklin in 1752 proved the identity of lightning and frictional electricity by means of a kite, which he elevated during a thunderstorm, tying a key at the end of a hemp string, and insulating the whole by fastening it to a post by a long piece of silk lace. Later he charged a Leyden jar and in both experiments obtained sparks. However, the former experiment was very dangerous, and a similar test later resulted in several experimenters being struck lifeless by electric currents. *Friction* was the only artificial source of electricity employed until Luigi Galvani in 1790 accidentally brought the limbs of a frog in contact with two metals. He noticed that when they came in contact with the metal a convulsion occurred as if they were in pain, and concluded that the effect was produced by what he termed animal electricity. It was his view that this electricity was different from that caused by friction, and that he had discovered the agent by which the will controls the muscles. Alessandra Volta (q. v.) rejected the idea of animal electricity, and developed the discovery of Galvani until he produced the *galvanic* or *voltaic battery.*

Hans Christian Oersted (1777-1851), of Copenhagen, Denmark, made discoveries in 1820 by which electricity and magnetism began to be studied as allied branches, instead of distinct studies. Andre Marie Ampère (q. v.), a French physicist, discovered that two parallel wires conveying an electric current in the same direction attract each other, but repel each other when in opposite directions. With this discovery the whole subject of electro-magnetism became generalized, and scientists turned their attention to the invention of the electric telegraph and hundreds of other modern devices. Among the inventors who made discoveries of vast value in the field of electricity are S. F. B. Morse, Thomas A. Edison, George Simon Ohm, A. G. Bell, Nikola Tesla, Michael Faraday, W. C. Röentgen, William Marconi, and Ernst Werner Siemens, all of whom are treated in special articles. See **Dynamo; Electrolysis; Galvanism; X-Rays.**

ELECTRICITY, Medical Use of, the employment of electricity in the treatment of diseases. In medical practice three forms are in general use; that is, the galvanic, static, and faradic. *Galvanic electricity* is obtained from a galvanic battery (q. v.), and is used extensively in treating many diseases of the nervous system. It produces a contraction of the muscle upon which it acts, and its application is accompanied by a sensation of heat and a buzzing sound. *Static electricity* is produced by a machine in which glass plates are revolved rapidly against chamois rubbers, and is seen in a succession of sparks that pass into the body of the patient, who is seated on a chair in which the feet are of glass. It has a great electro-motive force and is employed in medicine as a treatment of functional weakness, since it encourages respiration, secretion, circulation, and nu-

trition. *Faradic electricity* is obtained from a faradic battery, invented by Faraday (q. v.) in 1845, in which the current is made and broken with extreme frequency and rapidity. The current is applied by means of electrodes to the human body. It is used in treating paralysis of the muscles, hysteria, gout, and rheumatism. Another form of electrical machines is used in cauterizing and removing diseased or foreign tissues. Surgeons employ for this purpose an instrument in which the electrodes are joined by fine wire, the current raising the latter to a white heat. See **X-Rays.**

ELECTRIC LIGHT, the light obtained by

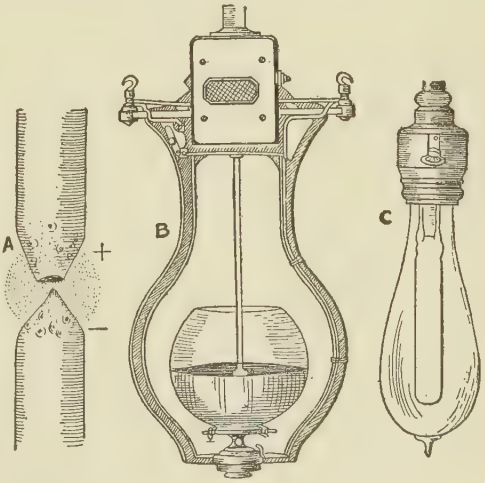


ELECTRIC LIGHT.

Fig. 1, arc lights; Fig. 2, tungsten lamps.

conducting a current of electricity through a resisting medium, as a gas or a carbon wire. Many devices are employed for utilizing the luminous effects of electricity for lighting and in electrolysis. The chief systems for lighting may be grouped as the arc and incandescent, both of which are in common use. In each of these a conductor conveys the current from a battery or dynamo D, and a brilliant light is obtained at any point where the current is broken. The so-called arc light is produced by connecting the two ends of the wire with two pointed sticks or pencils of carbon, and, when the carbon pencils are separated about one-tenth of an inch, the current passing from the positive to the negative pole, a light rivaling sunlight in whiteness results. The brilliant arc of light, called the voltaic arc, continues as long as the pencils are adjusted the proper distance from each other, which is provided for by a self-feeding mechanical contrivance. An intense heat is generated in an arc light, which is sufficient to fuse quartz and magnesium and melt platinum. Both carbons decrease in size, though the positive decreases more rapidly than the negative, and the latter remains pointed. The intense heat tends to volatilize the carbon, causing small particles of the positive carbon to be carried in the form of an arc or bow and to become condensed in the form of graphite. Arc lights give a light too brilliant for small rooms, but are favored greatly for large buildings and for street lights. The dynamo must yield a current of constant strength, but of varying potential, according to the number of lamps. In some systems of lighting as many as fifty or even seventy-five lamps are lighted by one machine, each lamp ranging in intensity from 500 to 2,000 candle power.

The incandescent lamp is obtained by rendering incandescent a thread or filament of carbon by passing through it a current of electricity. While there are various modes of obtaining the carbon filament, the common way is to press a carbonaceous paste in a die plate, and then finish by carbonizing. In the ordinary tungsten lamp a filament of the metal tungsten, little thicker than a horsehair, is drawn in the form of a circuit. The ends of the filament are fixed to two insulated platinum wires, and, as the metal readily burns in the air, practically all the air in the glass chamber must be exhausted. The lamp is then screwed into a socket, where the wires within the glass chamber are brought in contact with two insulated brass plates, in which the wire of the circuit terminates. Usually a large number of these lamps are connected with the same wire, and all take current from one of the line wires, returning it to the other wire of the circuit as shown in the illustration. However, all the lamps in a given system require the same current as every other. A turn-off enables one to close or open the circuit, thus lighting or extinguishing any one or all the lamps. A sixteen candle power tungsten lamp requires a current of about a half an ampere at 110 volts, or 55 watts.



ELECTRIC LIGHT.

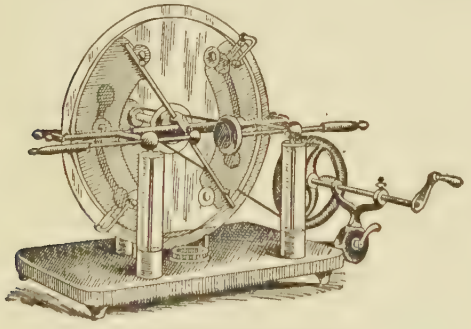
A, carbon pencils; *B*, arc lamp; *C*, tungsten lamp.

Improvements of vast value in electric lighting

were made in 1907, when the flaming arc lamp came into use. In this lamp the carbon is impregnated or cured with metallic salts, whose luminous vapors give increased light. Other newer forms include the helion, the Nernst and the metallized carbon lamps, but, while they have a strong lighting power efficiency, they are more costly and less efficient than the Mazda or tungsten lamp. Other improvements include those made in the mercury vapor lamp, which has been made highly serviceable in photography and other arts in which a brilliant white light is essential. Glass has been displaced to some extent in making the tube, from which the air is exhausted, and an intense light results when an electric current is passed from one electrode to the other through the vapor of mercury.

The electric currents ordinarily employed produce no marked mechanical effect, as those from a battery of Leyden jars, or a flash of lightning (q. v.), in which the results are destructive, especially if the path is formed of poor conducting material. Electric light, like solar light, acts chemically on chloride of silver in the photographic process. It is an important means of chemical analysis. When a current of electricity passes between two terminals or electrodes, through a compound liquid or electrolyte, it has the effect of decomposing the molecules of the electrolyte into constituent parts called ions or radicals. Decomposition occurring in this manner is called electrolysis.

ELECTRIC MACHINE, the name generally applied to any mechanism employed to convert mechanical energy into electric current. There is a very wide difference in construction



TOEPLER-HOLTZ MACHINE.

and capacity of the machines in common use for producing powerful electrical effects. Any machine depending upon the principle of the electro-magnet is now generally called a dynamo, which see. The mechanisms more properly designated electric machines include the two classes that depend upon friction and electrostatic induction, and are known respectively as *friction* and *influence* machines. The so-called plate electric machine is a common example of the former. It has a circular plate of glass, which may be turned on an axis by an insulated handle. A rubber with a surface coating of an amalgam is pressed by a spring against the plate, and is in electrical contact with an insulated conductor, termed the negative conductor. At the opposite side is a device with metallic points, which connect the positive conductor. When the handle is turned, a negative charge is manifest in the rubber, and a positive charge in the glass. As the motion of the machine continues the negative charge is conducted to the negative conductor and the positive conductor becomes charged positively by the electricity on the glass. The Toepler-Holtz machine, which is generally a revolving electrophorus, comprises a common electrostatic induction machine. The machines generally used in experiments in high schools and colleges belong usually to one of these classes, but there are mechanisms of similar construction sufficiently powerful to serve many purposes in the arts and industries.

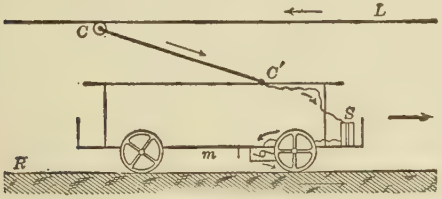
ELECTRIC METER, an appliance for measuring and recording the amount of electricity consumed. Three kinds are sold on the market, those known as clockwork recorders, motor meters, and chemical meters. The clockwork recorder has a stylus by which a record is made upon a chronograph sheet driven by clockwork as the current passes through a galvanometer. It is not used extensively on account of being expensive and because the clockwork devices are not easily maintained. The chemical meter is a zinc voltometer, and a record is obtained by weighing the plates from time to time. The motor meter is in general use. It is an electric motor, the speed of which is recorded by a dial device by means of a clockwork. This clockwork is connected with an armature, which revolves according to the speed of the current that passes through the meter. The watt, which is a current of one ampere, with a pressure of one volt, flowing for one hour, is the unit of measure. Each consumer of electricity usually has an electric meter, which is read once a month, and the amount paid for service depends upon the electric energy consumed.

ELECTRIC MOTOR, a machine used to convert electrical energy into the form of mechanical power. It is constructed on the plan of a dynamo (q. v.), but differs from it is that it is supplied with a direct electric current from an outside source, while the dynamo is used to generate electric currents. The iron masses or electro-magnets, called armatures, are set in motion by the action on them of stationary electro-magnets, hence the armature revolves as the effect of repulsion and attraction. The movement is at a uniform rate of speed, in case the current is constant and the resistance even. In general any dynamo is reversible and can be used as a motor, but these machines are constructed for particular purposes and in practice are not interchangeable. Dynamos are much

more powerful than motors and may furnish the power necessary to operate a number of motors, which may be located a long distance from the dynamo and from each other. Two motors of fifty horse power each, or ten motors of ten horse power each, may be supplied with power by a dynamo having 100 horse power.

Many machines are now operated by means of the electric motor, such as printing presses, cutting machines, elevators, pumps, etc. The advantage of the electric motor is chiefly in its convenience. It does not require a skilled operator and can be utilized in running machinery on a moment's notice. The power may be turned off as soon as a particular job or a definite part of the work is finished. The plant in which the dynamo is located may be a long distance from some or all of the motors, and the work of firing or looking after the power plant becomes centralized. In large factories, where work is done in many departments, the power plant may be in an isolated part of the building, and the employment of motors under such conditions entirely obviates the use of expensive belting, shafting, and pulleys.

ELECTRIC RAILWAY, a means of rapid transit on which the motive power is electricity. Various different mechanical devices are em-



ELECTRIC CAR.

ployed for this purpose, all depending upon the frictional or rolling contact of electricity supplied to a motor on the car or locomotive, either from a generating plant or from a storage battery. The electric railways are built similarly to the steam railroads, but in general the roadbed is not graded as level and is more tortuous, although the best service can be obtained on a straight and level track. The ties are of wood and the rails are iron or steel, but neither are quite as heavy as those used in steam railways. In cities the ties are now commonly laid in cement, so as to furnish a solid foundation for the street pavement, but in the outlying districts and in the country they are usually placed in a trench excavated about four to six inches from the surface of the roadbed. The size and construction of the cars differ greatly, both for the freight and passenger service, and the manner of applying the electric current is not uniform in all systems. In most of the American lines the power plant is located at some convenient point on the line, from which the conducting current is carried on a copper wire L in a continuous circuit immediately overhead of the center of the street railroad track, where it is suspended from a line of poles. The motor car, to which trailers, or other cars, may be connected, has a trolley CC′ attached to the roof, and by it the current is conducted by means of a wire through the switch S to the motor m, which has connection by gearing with the axles of the car wheels. Short copper wires or plates are bolted so as to connect the rails of the track, or the rails are united by electric welding, thus supplying a continuous circuit for the electric current, which passes through the motor into the car wheels, and thence back to the dynamo by the connected rails R.

Other methods include the underground or conduit, the third-rail, and the storage-battery systems. In the underground or conduit system the current is obtained by a sliding shoe, or some similar device, attached to an arm under the car, which comes in contact with an electric wire in a channel or conduit. The third-rail system is quite similar in its general operation to the overhead system, but differs from it in that a third rail is attached to the ties by means of insulated supports. Beneath the car is a sliding shoe, which operates to conduct the current to the motor, and it thence returns by the track rails. In the storage-battery system each car or train employs a storage battery, which is charged at the power plant, and usually carries sufficient power to supply motive force for one or more trips. All these systems are in use more or less, though the latter three more largely in Europe than America, while the overhead trolley system is the general system employed in America. The third-rail system is quite popular in Europe, and has the advantage of overcoming the overhead obstruction of trolley wires, but greater care must be exercised to guard against danger to pedestrians. Many of the elevated railroads make use of the third-rail system, as is evidenced in Chicago and other American cities.

Railway companies are now using electric locomotives to a considerable extent. They resemble the steam locomotive and are fully equal to it in power. The transmission used is either the overhead trolley or the third rail. Locomotives of this kind have been in use for some time on some branches of the Baltimore and Ohio and other systems. A large locomotive has four motors of about 600 horse power each. It is provided with a whistle, sand boxes, and automatic air brakes.

The history of the electric railways dates from 1879, when Dr. Siemens (q. v.), of Berlin, Germany, demonstrated their practicability on a track 220 yards long at the Berlin Exposition. Two years later an electric railroad a mile and a half long was put in successful operation in Berlin, and from thence the enterprise spread to other European cities, and then to America. The first line in the United States was built at Allegheny, Pa., in 1882, though Edison experi-

mented with a line at Menlo Park, N. J., some time before. At present practically all the cities of Canada and the United States with a population of about 10,000 or more have electric railways, and in the thickly settled portions hundreds of miles are operated through suburban and rural districts. There is scarcely a thriving city in the world that has not introduced electricity as a lighting or propelling agent, except in various portions of Asia. In 1922 Canada and Newfoundland had 2,380 miles of electric railways in operation, while the United States had 48 682 miles.

ELECTRO-CHEMISTRY (ĕ-lĕk'trō-kĕm'-ĭs-trў), the branch of chemistry which treats of the chemical changes that are due to electrical energy, and investigates the chemical changes by which electricity is produced. That electricity causes chemical changes may be illustrated by placing two platinum rods in a strong solution of common salt, then connecting them with a battery or a dynamo, when the current will decompose the solution and the sodium will be set free at the negative electrode, while caustic soda will be formed as the sodium combines with the water, and at the same time the chlorine will escape in bubbles through the liquid being set free at the positive electrode. That chemical action produces electricity is demonstrated by placing a zinc bar in a solution of zinc sulphate and a copper bar in a solution of copper sulphate, the solutions being separated by a porous partition, and as soon as the rods are connected by wire a current of electricity will pass through the circuit. Electro-chemistry is employed in the manufacture of various chemical products, in extracting metals from their ores, and in electrotyping and electroplating. It enters into the manufacture of carborundum, chlorine, soda, and potassium chlorate.

ELECTRO-CULTURE OF PLANTS, the method of stimulating the growth and development of plants by the use of electricity. Practical use has shown conclusively that electricity may be used as a stimulus in the form of electric light and by applying the current to the soil, the seed, and the plant. It has been demonstrated that seeds germinate more rapidly by applying electric stimuli before planting, requiring about half the time needed for seed untreated. Another method is to electrify a plot of ground by placing a system of wires in the soil, which are attached to a battery or electric machine at stated intervals. By either of these methods it is possible to increase the production of vegetables, especially peas, parsnips, tomatoes, beets, onions, and carrots. Both the arc and incandescent lights have a visible effect upon growing plants, in that they furnish beneficial rays and prevent injurious rays from passing through them. The flowering of Easter lilies has been hastened as much as ten days and at the same time the colors have been improved, while the yield of lettuce has been increased considerably. The use of electricity in the culture of plants is comparatively new, but it is reasonably certain that the yield of both flowers and fruit can be increased sufficiently to cover the expense.

ELECTROCUTION (ĕ-lĕk-trō-kū'shŭn), the method of inflicting corporal punishment by passing a current of electricity through the body of the criminal. The State of New York adopted this method in 1888, and since then it was adopted in Ohio and recommended by many commissioners and committees. It is looked upon as more humane than either hanging or decapitation, since death is painless and instantaneous.

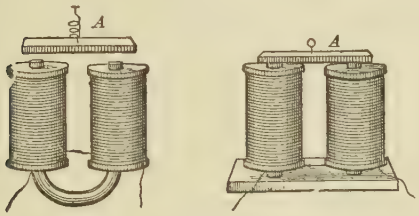
ELECTRODE (ĕ-lĕk'trōd), the terminals by which electricity is conveyed into and out of different media. The term is applied especially to the ends of the wires or conductors which lead from the source of electricity and terminate in the medium traversed by the current. Faraday introduced the terms *anode* and *cathode,* the former being the positive and the latter the negative electrode. The term is applied especially to the poles of the voltaic pile or battery.

ELECTROLYSIS (ĕ-lĕk-trŏl'ĭ-sĭs), the decomposition of chemical compounds by the action of a current of electricity. When an electric current is passed between suitable terminals or electrodes, through a compound liquid, or electrolyte, it decomposes the molecules of the electrolyte into two constituent parts called ions or radicals, which appear at the positive and negative electrodes. The electro-positive ions or radicals appear at the negative electrode, and the electro-negative ions or radicals, at the positive electrode. In salts of the metals, the metal itself is electro-positive, and the element or elements with which it is combined are electro-negatives. Electrolysis has been a subject for much discussion in the cities where strong electric currents are utilized in the industries, since it tends to destroy the metal pipes that are used in the construction of sewers and for gas and water mains. It is due to unsuitable lines for carrying return currents of electricity, hence these find their way back to the plant through the metal pipes lying underground. The subject has been one of considerable controversy between street railway companies and corporations having control of plants which utilize metal pipes, such as gas plants and waterworks.

ELECTRO-MAGNET (ĕ-lĕk-trō-măg'net). See **Magnetism; Electro-Magnetism.**

ELECTRO-MAGNETISM, the science which treats of the development of magnetism by voltaic electricity. Though the exact nature of electricity and magnetism is unknown, they are generally thought to be allied phenomena, as is evidenced by the fact that an electric current always produces a magnetic flux, or magnetism, when flowing through a conductor. Besides, a magnetic flux always causes electro-motive force when crossing an electric conductor, and enters

or emerges from a bend or curve in a conductor. It has been observed that a magnetic flux, surrounding a conductor through which an electric current is passing, flows around the conductor in concentric circular paths, and decreases in intensity as the distance from the conductor increases. The direction of the flow is dependent upon the electric current, and changes with every change in the direction of the current. Since the flux of all magnets flows from one pole and returns to the other, as shown by the armature A in the illustration, it follows that the loop or loops of an active conductor act as a magnet, and are similar to it in having two poles. The magnet produced in this way by an electric current is termed an electro-magnet.



ELECTRO-MAGNET.

The strength of an electro-magnet depends upon the quantity of magnetic flux flowing through the magnet. The strength of the magnet is increased by increasing the strength of the current, but also in the same current by increasing the number of loops. Thus, the strength of an electro-magnet depends on the number of turns or loops, or upon the strength of the current; both facts are taken advantage of in the construction of electric machinery. There is an attractive force between two unequally strong electro-magnets in proportion to the square of the sum of both currents. The accompanying cut shows the horseshoe magnet, which is the form preferred, since the two poles are sufficiently near together to permit the application of the armature A to both at once.

ELECTROMETER (ē-lĕk-trŏm'ĕ-tĕr), an instrument used in measuring the difference of potential between two charged conductors. The difference of potential is also measured by a *galvanometer,* but this is generally of high resistance, and, if calibrated to read volts, is called a *voltmeter.* Other devices used to indicate the amount of electricity with which a given conductor is charged are the *torsion balance* and the *electroscope.* Sir William Thomson (Lord Kelvin) is the inventor of the electrometer, and his quadrant-electrometer is the principal form of this instrument now in use. It has a needle of thin aluminium suspended over four quadrants which are connected in pairs. and the needle is attracted by one set and repelled by the other when the charges of electricity are communicated to the quadrant, the deflection depending upon the potential difference to which the quadrants are charged. Another form of the instrument has a small movable mirror suspended by a fine thread, and by it a spot of light from a lamp is reflected to a paper scale. The spot of light is seen in the middle of the scale when the two conductors have the same potential, and the potential difference, if any, is indicated by its movement to either side. These instruments are sufficiently delicate to indicate the potential difference of the two plates of a single galvanic cell.

ELECTRO-MOTIVE FORCE (ē-lĕk'trō-mō'tĭv), the force which produces, or tends to produce, electricity or an electric current. The words *electro-motive force* usually are contracted for convenience E. M. F. Any device by means of which an electro-motive force is produced is called an electric source. A voltaic cell, a dynamo-electric machine, or a frictional electric machine is an example of an electric source.

The term electro-motive force is sometimes used to express the degree of electrification as equivalent to potential, or, more properly, the difference of potential at the terminals of a cell when it is on an open circuit. It is the sum of all the differences of potential in the circuit when a cell is sending a current. The practical unit of electro-motive force is the volt, which is about equal to the electro-motive force of a standard Clark's cell at a temperature of 15 C. Wires carrying an electro-motive force of less than 200 volts are not considered dangerous, but those connected with a large dynamo usually carry a voltage of from 800 to 2,000.

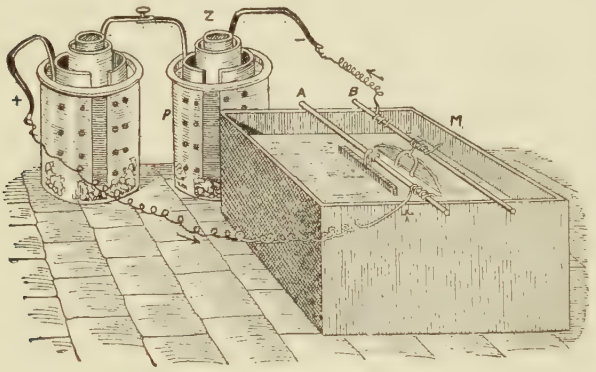
ELECTRONS. See **Einstein Theory.**

ELECTROSCOPE. See **Electricity.**

ELECTROTYPING (ē-lĕk'trō-tīp-ĭng), the process of producing copies of engraved plates, printing type, woodcuts, and other devices used in printing by means of an electric deposition of copper upon a mold taken from the original. The process consists of taking an impression of the object on beeswax, ozocerite, or gutta-percha, this being done on a powerful press. Various methods of treatment are employed, differing somewhat according to the material used. If beeswax is used, which is not a conductor of electricity, the surface is brushed with plumbago to render it a conductor. The mold is then suspended in a solution of copper sulphate in a vessel M, as shown in the illustration, from the negative pole B of a galvanic battery P, and a plate of copper is hung opposite on the positive pole A. As the copper is decomposed by the electric current, the metal goes to the negative pole and is deposited upon the mold. On the other hand, the acid, passing to the positive pole, operates to dissolve the copper, thereby preserving the strength of the solution While the process here described is still used,

it is now common to obtain the electric current from a dynamo-electric machine.

After the process is completed, which usually takes several hours, the thin shell formed in the mold is removed from the beeswax and backed up with electrotype metal. When smoothed, it is ready for the printing press, is mounted on blocks provided with ratchet and a foot, or attached to a wooden block, making it type high in either case. Electroplating is a similar process, but the coating is of silver or gold. It is usually preferred to use German silver, copper, brass, or nickel silver as the base, as both gold and silver are readily deposited on these. It is necessary to thoroughly cleanse the articles to be plated. In plating with silver a plate or bar of silver is hung on the positive pole, and in about five minutes a coating is deposited to conceal the other metal, which may then be polished. Gold plating is a similar process.



APPARATUS FOR ELECTROTYPING.

ELEGY (ĕl'ê-jĭ), a poem written in an earnest, melancholy style. The ancient Greeks and Romans applied the term to the martial lyrics and the erotic poems, and sometimes extended its use to describe the lessons of practical wisdom by such writers as Solon. Catullus was the first great elegiac writer of the Romans, and after him came Propertius, Tibullus, and Ovid. Modern literature contains many fine lyrics, such as Tennyson's "In Memoriam," Milton's "Lycidas," and Gray's "Elegy Written in a Country Churchyard."

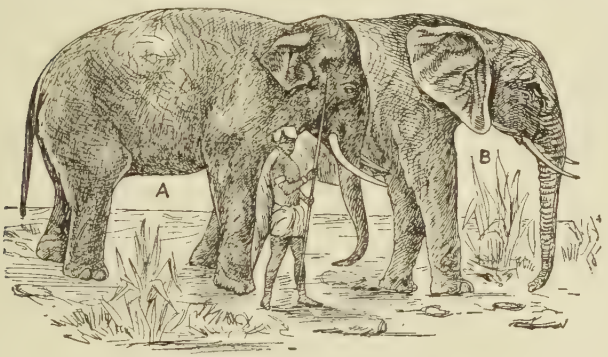
ELEMENTS (ĕl'ê-ments), the constituent principles of anything which have never been resolved into more simple forms of matter. The term has a different signification in modern science than it had formerly. The Greek philosophers assumed that four elements—fire, air, water, and earth—give rise to all the things that are manifest. Modern science considers matter as existing in four forms—imponderable, gaseous, liquid, and solid—while the elements are treated as the component ingredients of bodies under whatever form they exist. Neither air, water, nor earth are elements, and fire is a component of heat. For example, water is composed of two parts of hydrogen and one of oxygen. If a molecule of water be divided into three atoms, two of hydrogen and one oxygen, each division is an element. The number of elementary substances is not known, but about ninety are now admitted without further investigation. Oxygen, hydrogen, nitrogen, and carbon are the chief constituents of all organic matter. Rocks are composed chiefly of oxides, silicon, calcium, magnesium, aluminium, iron, sodium, potassium, and carbon. These, together with sulphur, hydrogen, chlorine, nitrogen, and oxygen, constitute by weight 99-100 of the earth's entire crust. See **Chemistry.**

ELEPHANT (ĕl'ê-fant), the largest living land animal, and the sole surviving representative of the suborder *Proboscidea.* Only two species of the family *Elephantidae* remain, the Asiatic and the African. The former is distinguished from the latter by its greater height, smaller ears, concave forehead, and four external hoofs on the hind foot, while the African has three. Elephants, when full grown, are from nine to fifteen feet high and weigh from 4,000 to 9,000 pounds. They live one hundred years and upwards. Elephants have remarkably large bodies, a thick skin, a scant growth of hair, a short neck, an enormous head, large legs and feet, and a proboscis or trunk. The proboscis is a huge elongation of the nose and upper lip, and is composed almost wholly of a mass of muscles, numbering, according to Cuvier, fully 40,000, which give it the greatest diversity of motion. The trunk is very strong and serves alike for respiration, smell, taste, touch, and prehension. At the extremity of the trunk, on the upper surface, are two fingerlike projections with a thick tubercle below, which acts the part of the thumb, the whole forming an organ of prehension comparable in many respects to the human hand.

With the trunk the animal collects food and takes in drink. It exercises extreme caution in using the trunk in combat; without it the animal is helpless, even to feed itself. It breathes through the openings in the trunk, which it can easily hold above the surface of the water while bathing or crossing a stream. Indeed, it is fond of an abundance of water and swims with ease and skill. It has no canine teeth and only two incisors on the upper jaw, which assume the character of tusks and attain an enormous size; a single tusk often weighs from 100 to 200 pounds. These tusks comprise the most elastic and best form of commercial ivory. In some species they attain a length of seven or eight feet, and serve to break off small branches, tear climbing plants from trees, loosen roots, fight other animals, and, in a state of domesti-

cation, to ply or carry timbers and move stones. Elephants have an ability to run quite equal to that of a horse. In lying down they do not place the hind legs beneath the body, but extend them backward in the manner of a person kneeling. The female breeds at fifteen years of age, bearing a single young at a birth; the period of gestation is about 21 months. The young elephant sucks with its mouth and not with the trunk.

Elephants associate together in considerable herds, under the guidance of a single leader, usually the most powerful animal. It gives the alarm in case of peril and controls the movements of the herd. In times of danger the herd is remarkably anxious to protect it, which is done by crowding so eagerly to the front that the hunters often shoot some less valuable individuals before it can be reached. Sometimes an elephant is driven from the herd, and is never allowed to join another, but ever after leads a solitary life. Such individuals are known as *rogues,* or *low-castes,* and are by far



A, Asiatic elephant; *B,* African elephant.

the most dangerous to meet. Elephants are domesticated and serve for tiger hunting, beasts of burden, and in time of war. The Romans were frightened when Hannibal brought a troop of elephants over the Alps, but later learned to use them in war and various arts of peace. It is indicated from fossil remains of the genus *elephas* that at least fourteen species lived in former times, while the species classed with the allied genus *mastodon* were still more numerous. Fossil remains appear in the Pliocene of North and South America and in the Miocene and Pliocene of Europe, but they became extinct in the Western Hemisphere and emigrated from Europe to Asia and Africa in the Pleistocene period.

ELEPHANTA (ĕl-ē-făn'tà), a small island of British India, in the Bay of Bombay, about five miles from the mainland. It is five miles in circuit and the surface consists of two hills with a valley between them. Near the main landing place are a number of temples or caves cut into the solid rock. The largest of these is 130 feet long and 123 feet broad, the roof is supported by pillars of great magnitudes, and the walls are sculptured by the Hindu trinity, Brahma, Vishnu, and Siva. These temples are used by the Baniya caste for certain Hindu festivals. It is thought that the temples are more recent than the birth of Christ.

ELEPHANT BEETLE, a giant beetle of Central America, so named from its large size. The length is about five inches, including a forked horn which projects from the head. It has a blackish color, but is covered with a yellowish fur. This fur is soft and upright and is easily removed by rubbing, hence most of the specimens are bare and appear almost black.

ELEPHANT FISH, the common name of the *chimaera,* so called from its upper extension of the nose, which resembles a proboscis. The flesh is esteemed as food, for which it is caught off the coast of the Cape of Good Hope and other regions of the South Pacific.

ELEPHANTIASIS (ĕl-ē-făn-tī'à-sĭs), a disease of the skin and areolar tissues, epidemic in the East and West Indies. It begins with headache and fever, after which the leg or arm becomes inflamed and tender and serum afterward exudes. Attacks will follow each other and the affected limb will become very large in size. Some cases are due to malarial infection, while others result from the bite of certain mosquitoes. The elephantiasis of the Greeks is a form of leprosy.

ELEPHANTINE (ĕl-ē-făn'tē-nā), an island in the upper Nile, opposite Assuan, known anciently as Syene. It is formed of granite covered with a fertile soil, and is about a half a mile wide and one mile long. Herodotus mentions it as the boundary between Egypt and Ethiopia, but afterward Phyle was regarded as the southern landmark of Egypt. The island contains many ancient ruins, including several temples, fragments of pottery with Greek inscriptions, and a gateway of the time of Alexander. The Persians as well as the Romans fortified Elephantine as an important strategic point.

ELEPHANT SEAL, the proboscis seal, or sea elephant, so named from the proboscislike projection of the upper lip of the male. It is the largest of the seal family, often attaining a length of twenty to thirty feet. The female is much smaller than the male and has no proboscis. Two species have been described, one found off the coast of western Mexico and California, and the other in the vicinity of the Kerguelen Islands, Heard's Island, and Patagonia. However, both are becoming rare because of extensive slaughter. These animals are hunted for their oil, which burns with a clear flame, a single individual yielding about twenty gallons. The skin is useful in making harness and other products made of leather.

ELEUSIS (ē-lū'sĭs), a celebrated city of

ancient Attica, formerly situated on the Bay of Eleusis, near the confines of Megaris, and connected with Athens by the Sacred Road. Its fame is due largely to the festivals observed by the Greeks in honor of Demeter. The *Eleusinian Mysteries,* as the festivals were called, were divided into the greater and lesser, and, according to general account, held every five years. The lessons taught were of the highest moral character and were intended to inculcate the doctrine of the immortality of the soul. It was held that the souls of those who participated in them were filled with sweetest hopes, both of this and the future world, and that in them no one was sad. The ceremonies were awe inspiring, and their secrecy was strictly enjoined by the death penalty. Initiation in the lesser prepared for admittance to the greater, the initiation into both being followed by numerous games given amid great rejoicing.

ELEUTHERA (ĕ-lū'thēr-à), an island of the Bahamas, about seventy miles long and from two to ten miles wide. The area is 235 square miles. It produces Eleutheria bark, a bitter, aromatic bark sometimes called cascarilla, fruits, live stock, and cereals. Governor's Harbor is the chief town. Population, 1922, 8,843.

ELEVATED RAILWAY, a line of railway built in large cities, usually on a framework erected on the surface of the street. Formerly the framework was constructed of timbers, but now it is entirely of iron pillars, spanned by crossbeams, and mounted by plate girders. Passengers ascend by stairways or elevators to the stations, which are usually from two to four blocks apart, and the fare is generally collected when passing from the depot to the platform at which the car is entered. Elevated railway transportation has the advantage of being more rapid than surface lines, since the cars stop only at the stations and are not obstructed by traffic on the streets. In 1867 the first elevated railway was built in New York, and the success of the enterprise caused the system to be extended in that city and established elsewhere. Extensive lines are now operated in Brooklyn, New York, Boston, and Chicago. The principal elevated railways of Europe are in Berlin, Paris, and Liverpool. Electricity is the chief motive power. Some of the cities in Germany have suspended railways, in which the cars are suspended beneath the girder, such as the line between Barmen and Elberfeld.

ELEVATOR (ĕl'ê-vā-tēr), an apparatus consisting usually of a cage or movable platform, and used to raise and lower persons and goods in large buildings. These mechanical contrivances are comparatively modern and are in extensive use in the large cities of America, Australia, and Europe. They have materially increased the usefulness and convenience of high buildings. The public has become accustomed to the use of elevators, and general confidence in the efficiency and safety of these beneficial devices has led to their extensive employment. The security of the passenger elevator is assured by the multiplication of cables, by means of which the elevators are lifted and lowered while under perfect control of the operator. Four cables are usually employed to facilitate movement, two for attaching counterbalance weights, and several safety appliances are attached to guard against danger from moving downward at an excessive speed. The modern improvements added have rendered it as safe to ride in an elevator as on an ordinary street car, while the time consumed in passing to the highest fifteen or twenty story buildings has been reduced to only a moment.

Passenger elevators are operated either by hydraulic or electric power. The water pressure in hydraulic elevators is supplied from tanks, which are filled by means of powerful pumps located in the basement, air-pressure devices being utilized quite extensively for that purpose. By means of hydraulic passenger elevators it is possible to ascend with much smoothness of motion and entire safety at a rate of from 300 to 400 feet per minute. Within recent years the electric elevators of various construction have gone into general use, and are preferred to the hydraulic kind for various purposes. They are constructed in such a manner that a rope is wound around a large drum by the agency of electric motors, thus causing the cage or platform to be moved up or down with entire satisfaction. This form is simpler than the hydraulic and can be operated at a much smaller cost.

The construction of tall buildings with forty or more stories has made the hydraulic and the ordinary electric elevators undesirable, since the former occupies too much space and the latter requires a drum which is too large in size. Accordingly, a new type of the electric elevator has been devised, in which either the direct traction or the cable drive is employed. In both of these systems the application of power is identical with that employed in street railways. The term elevator is applied to buildings used for the storage of large quantities of grain. It is applied also to a mechanical contrivance consisting of a belt to which boxes or buckets are attached, being used for the purpose of elevating grain and commodities. A good example of the latter is found in threshing machines. See **Grain Elevator.**

ELGAR, Sir Edward William, musician, born at Broadheath, England, June 2, 1857. He studied at Littleton House and afterward received private instruction on the violin and the organ. He began as a conductor at Worcester in 1882, and three years later became organist at Saint George's Church. In 1889 he gave up these positions and devoted his attention entirely to composition. Many of his works are well known in Canada and the United States, where they are quite as popular as they are in England. Edward VII. knighted him in 1904,

and the following year he was granted the degree of doctor of music by Yale University. Among his productions are the oratorio "The Light of Life," the cantata "The Black Knight," and the concert overture "Cockaigne." In 1903 he produced "The Apostles" at the Birmingham festival, and it was reproduced in German at Cologne in 1904.

ELGIN (ĕl'jĭn), a city of Illinois, in Kane County, on the Fox River, about 35 miles northwest of Chicago. It is on the Chicago and Northwestern and the Chicago, Milwaukee and Saint Paul railroads and on the Chicago, Elgin and Aurora Electric Railway. The noteworthy buildings include the Northern Illinois Hospital for the Insane, the public high school, the Gail Borden Public Library, the Elgin Academy, and a college of music. Water power for industrial purposes is obtained from the Fox River. Among the manufactures are cut-glass, watches, farming implements, washing machines, cigars, and condensed milk. It has several cotton and soap factories and meat-packing establishments. The output of watches aggregates about 2,000 daily, in which industry 2,800 skilled laborers are employed. The streets are generally well paved and improved by grading and drainage. Elgin was settled in 1835 and incorporated in 1854. Population, 1900, 22,433; in 1920, 27,454.

ELGIN MARBLES, the celebrated collection of ancient sculptures brought from Greece by Thomas, seventh Earl of Elgin, and purchased in 1816 by Parliament for the British museum at a cost of $175,000. The sculptures are among the best that adorned certain buildings on the Acropolis of Athens. They include those of Theseus or Hercules, the torso of Cecrops, the Fates, Proserpina, Iris, Ceres, the torsos of Neptune and Minerva, the heads of the horses of Hyperion, and one of the horses of Night. Their removal to England was generally condemned as an act of injustice, a view in which Lord Byron concurred.

ELI (ē'lī), a judge of Israel and a priest at the temple of Shiloh, the predecessor of Samuel. He judged Israel forty years, but was unable to overcome the reluctance and rapacity of his sons, Hophni and Phinehas, which displeased the people. The Philistines took advantage of his weakened authority by advancing against Israel. They gained a completed victory in the Battle of Ebenezer, slew both of Eli's sons, and carried off the ark of God. When Eli heard the news, he fell from his seat and died, being then 98 years of age. See I. Sam. iv, 15-18.

ELIJAH (ē-lī'jah), called Elias in the New Testament, the greatest and sternest of the prophets of Israel, born at Tishbe, in Gilead. His history is given in connection with the reigns of Ahab (I Kings xvii-xxi) and his successor, Ahaziah (II Kings i-ii). He flourished in the time of Ahab about 920 B. C. When that monarch had introduced the worship of Baal, Elijah pronounced a curse on the land, but he was obliged to flee for safety. He took refuge by the brook Cherith, where he was miraculously fed by ravens. Subsequently he went to Zarephath and lodged with a widow, prolonged her supply of oil and meal, and restored her son to health. An extended drought and famine led to a reconciliation with Ahab. Soon after he demonstrated the vanity of the worship of Baal. This caused the people to destroy the idolatrous prophets, a circumstance leading Queen Jezebel, wife of Ahab, to vow vengeance. To escape her anger he fled to Mount Horeb and hid in a cave, where he had an interview with Jehovah, who instructed him, and advised the selection of Elisha as his successor. When Ahab wrongfully took possession of Naboth's vineyard, Elijah denounced the monarch and pronounced a curse upon him and his wife. Later he denounced the son and heir of Ahab, Ahaziah, who vainly sought to destroy him. He visited the prophets at Bethel and proceeded with Elisha across the Jordan. While there a chariot and horses of fire appeared, and he was taken up by a whirlwind into heaven. According to Jewish tradition, he is to return for the restoration of Israel, though Christians hold that prophecy was fulfilled by the advent of John the Baptist. In the transfiguration of Christ, Elijah appeared with the Savior and Moses.

ELIOT (ĕl'ĭ-ŭt), **Charles William,** educator, born in Boston, Mass., March 20, 1834. He graduated at Harvard in 1853, was appointed tutor in mathematics at Harvard in 1854, and later became assistant professor in mathematics and chemistry. In 1861 he was engaged as teacher of chemistry in the Lawrence Scientific School. He studied chemistry in Europe in 1863-65, and, on returning to Massachusetts, became professor of analytical chemistry in the Institute of Technology, and was made president of Harvard University in 1869. His efficiency in higher education has had a marked effect on the educational status of America. His distinguished abilities were recognized by Williams, Princeton, and Yale, from each of which he received degrees. Besides holding membership in many domestic and foreign scientific associations, he acquired much repute by active coöperation in the American Academy of Science. In 1908 he resigned from the presidency of Harvard, after a useful service of about forty years, to devote himself more closely to literary work. Among his publications are "The Compendious Manual of Qualitative Chemical Analysis," "Essays and

CHARLES W. ELIOT.

Addresses," "The Happy Life," "Educational Reform," "American Contributions to Civilization and Other Essays," and "Manual of Inorganic Chemistry." He died Aug. 22, 1926.

ELIOT, George, the literary name assumed by Marian Evans, celebrated novelist, born in Warwickshire, England, Nov. 22, 1819; died in London, Dec. 22, 1880. She was the daughter of Robert Evans, a land agent and surveyor, and a man of strongly marked traits of character. At the death of her mother, in 1836, she assumed management of the house. Her school training was received at Nuneaton and Coventry, though her culture was largely self-acquired through a passionate habit of reading and study. She removed with her father to Coventry in 1841, where she made the acquaintance of Charles Bray, an author of several standard works in philosophy, and formed a close friendship with his family. Soon after the death of her father, in 1849, she traveled through Switzerland, and, returning to England, began to write for the *Westminster Review.* Her writings attracted the attention of John Stuart Mill, Herbert Spencer, and George Henry Lewes, who gave them favorable mention. She formed an irregular marriage union with the last mentioned, which remained unbroken until his death in 1878. His decease was largely the cause of her withdrawal from the conventional forms of society, and, perhaps prompted her to give a larger share of attention to literary work.

GEORGE ELIOT.

Among the best works of George Eliot are her translations from the German, in 1846, of Strauss's 'The Life of Jesus" and "The Essence of Christianity." After completing these works, she declared herself highly interested in the beautiful story of the former. Several sketches contributed by her to *Blackwood's Magazine* in 1857 attracted much attention. Two years later her novel of real life, "Adam Bede," gave her a reputation for masterly insight into character and remarkable knowledge of human nature, combined with much power of description. This work fixed her place among the eminent novelists, and still remains the most popular of her productions. Soon after appeared "The Mill on the Floss," "Silas Marner," "Romola," "Felix Holt," "Middlemarch," "Daniel Deronda," and "Impressions of Theophrastus Such." Among her poetical works are "The Legend of Jubal," "The Spanish Gypsy," and "Agatha." Her productions in poetry are quite equal to her prose, though the prose writings contain greater power of imaginative creation and a more delicate finish. In 1880 she married John Walter Cross, an intimate friend, but died soon after. An extensive biography, entitled "George Eliot's Life as Related in Her Letters and Journals," was published by him shortly after her death.

ELIOT, John, eminent minister, born in Hertfordshire, England, in 1604; died in Roxbury, Mass., May 20, 1690. He was educated at Cambridge, where he obtained a bachelor's degree in 1623, and in 1631 emigrated to America. He officiated for a year in the first church of Boston, and in 1632 received an appointment as pastor of the church in Roxbury, where he remained until his death. He became interested in studying the Indian language by means of an interpreter, and in 1646 was able to preach the gospel to the Indians in their own language. His success in interesting these people attracted attention in England and occasioned several allowances to support him in his efforts. While engaged in his ministerial work, he made a translation of the Bible into the Indian language, completing the New Testament in 1661 and the Old Testament two years later. The "Indian Version of the Scriptures," published at Cambridge, Mass., was the first book printed in New England. About 3,500 Indians were converted to Christianity through the vigorous work of Eliot, though the ill feeling which developed against the English during King Philip's War, in 1675, caused many to fall back into their old ways. Eliot was acknowledged as a man of excellent temper, simplicity of life, and much goodness. Numerous works on Christianity, logic, and Indian history were published by him.

ELIOT, Sir John, statesman, born at Port Eliot, England, April 20, 1592; died Nov. 27, 1632. He was the son of a country gentleman, received a liberal education, and traveled extensively through France, Germany, and Italy. At the early age of 22 he entered Parliament, and when 27 was appointed vice admiral of Devon. He was again elected to Parliament in 1624 as a supporter of the Duke of Buckingham, but soon after became at variance with him, owing to the close friendship of the duke with Charles I., who refused to acknowledge that in the House of Commons is vested the principal ruling power of the nation. The vigorous and able statesmanship of Eliot made him the leader of Parliament against the encroachment of the king, and secured the adoption of its policy and the impeachment of Buckingham. He was imprisoned in the Tower for nine days on account of his persistent opposition in this struggle against the claims of the house of Stuart, but in 1628 the House of Commons wrung from the king the second charter of liberty, the right of petition, mainly through his vigorous agitation. By this charter the king gave up all claim to the power of levying taxes

and was denied the authority to imprison a subject at will, as well as the right to quarter soldiers in any house without the consent of the owner. After a short time Charles I. disregarded the charter. Eliot was again sent to the Tower in 1629, where he remained until his death.

ELIOT, Samuel, historian and educator, born in Boston, Mass. Dec. 22, 1821; died Sept. 15, 1898. He graduated at Harvard in 1839, traveled in Europe four years, and in 1856 became professor of history and political science at Trinity College. He was its president in 1860-66, and in 1864-74 lectured on constitutional law and political science in the same institution. In 1870-73 he was professor in Harvard, served as master of the Boston Girls' High School in 1872-76, and was superintendent of the Boston public schools in 1878-80. He was overseer of Harvard in 1866-72, serving as president of the American Social Science Association about the same time. His power as a teacher and lecturer had a marked influence upon the schools of Boston and the State of Massachusetts, and as an educator of America he takes very high rank. Among his publications are "History of Liberty," "Manual of United States History," "The Early Christians," "The Monarchical Ages," and "The American Nation."

ELISHA (ē-lī'shȧ), a prophet of Israel, successor of Elijah, who prophesied a period of 55 years. He was consecrated to the sacred office by having the mantle of Elijah thrown over his shoulders, as the former was taken up into heaven. He divided the Jordan while on his way to Jericho. When children laughed at him for his bald head, while on the road to Bethlehem, he cursed them and they were devoured by two she bears. Among the miracles ascribed to him are those of prediction, the healing of the sick, and even the raising of the dead, though he is regarded inferior to his predecessor. His death is commonly assigned to the year 840 B. C. The history of his life is given in II Kings.

ELIZABETH (ē-lĭz'ȧ-bĕth), a city of New Jersey, county seat of Union county, on Staten Island Sound, four miles southwest of Newark. It is on the Pennsylvania, the Central of New Jersey, and several electric railroads. The noteworthy buildings include the county courthouse, the post office, the public library, and a number of churches, schools, and hospitals. It is important as a shipping point of coal, iron, and merchandise. Among the principal manufactories are those producing cordage, sewing machines, ironware, railroad cars, machinery, fertilizers, and motor boats. The surrounding country is fertile and produces large quantities of cereals, fruits, and live stock. It has gas and electric lighting, waterworks, sewerage, and a growing wholesale trade. The place was settled in 1609 by representatives of the East India Company. In the Revolutionary War it was the scene of a battle, and was made the point for exchanging prisoners during that period. It was chartered as a city in 1855. Population, 1905, 60,509; in 1920, 95,682.

ELIZABETH, Queen of Rumania, born in Neuwied, Germany, Dec. 29, 1843. Her father, Prince Herman of Wied, gave her a liberal education, and, after reaching her twentieth year, she spent five years in European travel. On Nov. 15, 1869, she married Karl, Prince of Hohenzollern, who was crowned King of Rumania on May 22, 1881. During the wars waged for the throne by her husband she was the Florence Nightingale who hovered in the rear of the army to relieve those in distress. After her husband ascended the throne, she made strenuous efforts for the welfare of the people, and through her influence schools, asylums, and charitable institutions of all kinds were established. As a writer she is known by the name of Carmen Sylva. Most of her books are in the German. Besides translating numerous works from the older Rumanian, she wrote several novels and made a valuable collection of poems. Among her best known works are "My Rest," "Tales of the Carpathians," and "Life of Carmen Sylva." She died March 2, 1916.

ELIZABETH, Empress of Austria, wife of Francis Joseph, born Dec. 24, 1837; assassinated Sept. 10, 1898. She was the second daughter of Duke Maximilian Joseph, who belonged to the Wittelsbach family, which formerly held sovereign title over several German states. Her education was liberal in every detail, and she acquired skillful use of all the languages of civilized Europe, was able to speak all the dialects of Austro-Hungary, and attained much knowledge of ancient Greek. She is classed as the most highly accomplished queen of the last century. Her assassin, an Italian anarchist calling himself Luccheni, gave no other reason for his rash act than that he loved the poor and hated the rich.

ELIZABETH, Queen of England, daughter of Henry VIII. and Anne Boleyn, born at Greenwich, Sept. 7, 1533; died March 24, 1603. She was declared heiress to the crown shortly after her birth. However, in her third year her mother was beheaded and both she and her sister Mary were declared bastards, but she was finally placed in the order of succession after Prince Edward and the Lady Mary. When Edward VI. ascended the throne, she

QUEEN ELIZABETH.

was placed in care of Catharine Parr, the queen dowager, and later was taken to Hatfield, where she obtained a classical education under such eminent teachers as William Grindal and Roger Ascham. Besides learning the arts of music and attaining high skill in science, she learned to converse freely in German, French, Latin, and Greek. As a matter of self-defense she manifested zealous adherence to the Roman Catholic faith, though her inclination to Protestantism was generally suspected. Immediately after the death of Mary, Nov. 17, 1558, she was recognized queen by Parliament amid much rejoicing of the Protestants and with the approval of moderate Catholics. Her ascent was followed by the reëstablishment of the ecclesiastical system devised during her father's reign, and the act of uniformity enforced the revised prayer book. She declared her intention to live and die a virgin, though she was approached by Parliament on the serious question of the succession to the crown and had numerous suitors, among them Eric, King of Sweden, Philip of Spain, Henry III. of France, and Archduke Charles of Austria.

The reign of Elizabeth ranks among the shrewdest and most important in English history. To the wisdom she exercised in engaging as her advisers the ablest men of the kingdom is due largely the growth of Great Britain into a world power. Among the unfortunate events may be named the jealousy that existed between her and Mary, Queen of Scots, which resulted in the beheading of the latter, and the many persecutions to which the Catholics were subjected. On the other hand are numerous facts of history that make her a most distinguished character for influence and power. Among them may be named the destruction of the Spanish Armada in 1588; extensive influence at the courts of France, Holland, and other countries, making her a potent factor in the political affairs of Europe; and vast strides of advancement in architectural arts and commercial relations.

The Elizabethan architecture is an outgrowth of the inferior Gothic and Italian. Though not particularly preferable, it met the wants of an advancing civilization and was far superior to the styles formerly employed extensively in England. In her youth she was described as a maid of auburn hair and delicate white hands, but with manners and face almost masculine. A description made of her at 65 years related that she wore false red hair, a white silk dress bordered with pearls, earrings of large pearls and profuse decorations of gold and diamonds. In the affairs of government, abroad and at home, she was supported by such men as Bacon, Burleigh, and Walsingham.

ELIZABETH, Saint, daughter of Andreas II., King of Hungary, born in Presburg, Austria, in 1207; died in Marburg, Germany, Nov. 19, 1231. She was affianced to Louis IV., landgraf of Thuringia, at the age of four, brought up in the family of her future husband's parents, and married at the age of fourteen. Her husband died while engaged as a Crusader at Otranto under the leadership of Barbarossa, after which she devoted her life exclusively to religion and charity. Pope Gregory I. placed her in the list of saints four years after her death. Her fame for goodness, purity, and devotion to the service of God shines with a luster of remarkable brightness, while many are the stories of the suffering and distress she relieved while in the service of her Master.

ELIZABETH CITY, a city in North Carolina, county seat of Pasquotank County, on the Pasquotank River, forty miles south of Norfolk, Va. It is on the Norfolk and Southern and other railroads. The chief buildings include the high school, the customhouse, and the State normal school. It has a good harbor and a large trade in cotton, oysters, fish, and tobacco. Among the manufactures are cotton textiles, flour and grist, wagons, brick, lumber products, and machinery. Oysters are cultivated in the vicinity. It has systems of public sewerage and lighting. Settled in 1793, it was incorporated the same year. Population, 1920, 8,925.

ELIZABETH ISLANDS, a group of sixteen islands between Vineyard Sound and Buzzard's Bay, belonging to Dukes County, Massachusetts. Naushon has an area of eight square miles, is the largest of the group, and contains handsome private and summer residences. John Anderson gave Penikese, an island of this group, with an endowment of $50,000 to Louis Agassiz, in 1873, for conducting a summer school, though the institution has since been discontinued. In summer the islands are visited by tourists and pleasure seekers. Population, 1922, 164.

ELIZABETH STUART, Queen of Bohemia, daughter of James I. of England, born Aug. 19, 1596; died Feb. 13, 1662. On Feb. 14, 1613, she married Frederick V., the German elector-palatine, who was elected to the throne of Bohemia by the German princes. Through her the Stuarts inherited the throne of England.

ELK, or Moose Deer, the largest living species of the deer family, native to Europe and Asia. It stands, when full grown, about six feet and in weight averages about 1,000 pounds. The neck is very short and thick, adapting the animal for draft purposes. In all species the head is large, fully two feet long, and crowned with prominent horns, which branch out almost from the base into a broad, palmate form, with numerous snags. A single antler frequently weighs fifty or sixty pounds. The limbs are long and quite graceful. A fully developed elk will draw a sledge more than 200 miles a day, the gait being a shambling trot. The elk is timid and inoffensive, except when wounded, when it becomes aggressive. A single, well-directed

stroke of its forefoot is sufficient to kill the largest dog. The flesh is esteemed a good kind of venison and is much sought as an article of food.

The so-called American elk does not belong to this class of animals, since it more nearly resembles the red deer, and the proper name is Wapiti (q. v.). Occasionally one of these animals is seen in the northern part of the United States, but they are fast disappearing even in Canada. They inhabit marshy and dense timber regions and live separately, except during the rutting season. The Irish elk, which is now extinct, was closely allied to the fallow deer. Remains of it are found occasionally in the bogs and caves of the British Isles and the western part of Europe. This animal was remarkable for its large antlers, which in some specimens measured as much as eleven feet from tip to tip.

WAPITI, OR AMERICAN ELK.

ELKHART (ĕlk'härt), a city of Indiana, in Elkhart County, at the confluence of the Saint Joseph and Elkhart rivers, 98 miles east of Chicago, Ill. It is on the Big Four, the New York Central, and other railroads, and is surrounded by a fertile agricultural country. Among the noteworthy buildings are the Carnegie library, the high school, the city hall, and the Municipal Building. The principal manufactures include paper, radios, musical instruments, machinery, automobiles, flour, and brass novelties. It has extensive railroad machine shops and other industries. The streets are well graded and paved, principally with brick, and the municipality has systems of sewerage and lighting. It is the center of a large trade in produce and merchandise. Population, 1920, 24,277.

ELKHORN, a river of Nebraska, rises in Rock County, flows in a general southeasterly direction, and joins the Platte River about 20 miles west of Omaha, after a course of 250 miles. The valley of the Elkhorn is noted for its fertility. It contains numerous enterprising towns and cities.

ELKINS, county seat of Randolph County, West Virginia, on the Western Maryland and other railways. It has extensive machine shops, planing mills, tanneries, and wholesale trade. The features include the courthouse, high school, and Y. M. C. A. building. It was settled in 1889. Population, 1920, 6,788.

ELKINS, Stephen Benton, statesman, born in Perry County, Ohio, Sept. 26, 1841; died Jan. 4, 1911. He studied in the schools of Missouri and graduated from the State University of Ohio. He was elected to the United States Senate in 1894, in 1900, and in 1906.

ELKS, Benevolent and Protective Order of, a benevolent and fraternal society founded in 1868 in New York City. It is the outgrowth of a social club known as the Jolly Corks, a society of members of the theatrical profession, and its purposes are social and philanthropical. The largest membership is in the United States, where the order has about 1,519 subordinate lodges with a membership of 810,000. Eligibility to membership is limited to white male citizens of the United States of good moral character, 21 years of age, and subordinate lodges are not permitted in cities that have a population less than 5,000. This order has many fine buildings in the larger cities. Its official organ, the *Elks Magazine,* is a monthly publication.

ELLESMERE LAND (ĕlz'mēr), the name of a large tract of land in the Arctic region of North America. It is located north of Jones Sound and west of Greenland, from which it is separated by Smith Sound. It is part of the northernmost region of the Western Hemisphere and consists chiefly of a barren and uninhabited plateau. William Baffin visited it in 1616, and it was partly explored in 1899, when it was found that Hayes Sound does not separate it from Grinnell Land, which lies immediately north.

ELLET (ĕl'let), **Charles,** civil engineer, born in Bucks County, Pennsylvania, Jan. 10, 1810; died June 21, 1862. He studied mathematics and mechanics, first as a rodman under competent surveyors, and afterward took a course of instruction in France. Subsequently he was made chief engineer of the James River and Kanawha Canal. His first work to attract much attention was the construction of a wire suspension bridge, the first in America, which was built across the Schuylkill River in Philadelphia in 1842. In 1848 he built a span of 960 feet across the Ohio River at Wheeling, and soon after made the original plan for the suspension bridge across the Niagara. In the Civil War he rendered valuable service to the Union cause by carrying out important engineering work. His skill caused the Mississippi gunboat flotilla to be protected and many Confederate vessels to be destroyed, and facilitated the capture of Memphis. He was wounded by

a musket ball at Memphis, which, together with impaired health caused by arduous labors, resulted in his death at Cairo, Ill. His publication, "Coast and Harbor Defenses," has served a very useful purpose.

ELLIOTT (ĕl'ĭ-ŭt), **Jesse Duncan,** naval officer, born in Maryland in 1782; died Dec. 18, 1845. He studied at Carlisle, Pa., and in 1804 joined the United States navy as a midshipman. In the War of 1812 he won several successes for the Americans on the Great Lakes. He was second in command to Perry in the Battle of Lake Erie in 1813, and the same year succeeded to the command of the Lake Erie fleet. In 1815 he commanded the sloop of war *Ontario* under Decatur in the war against Algiers, and three years later was raised to the rank of captain. He commanded the *Constitution* in the Mediterranean squadron for several years, and in 1840 was suspended from duty for four years, after having been tried by court-martial.

ELLIPSE (ĕl-lĭps'), an important figure in geometry. It is a plane curve, the sum of the distances of two straight lines drawn to two fixed points within the curve being always the same. These two points are called the *foci,* each being a *focus.* The diameter drawn through them is the major axis; the minor axis bisects the major at right angles. The distance from the center to the foci divided by the semimajor axis is called the *eccentricity* of an ellipse. The less the eccentricity, the nearer the figure approaches a circle. Kepler made the discovery that the planets' orbits around the sun are ellipses, the sun occupying a position in one of the foci.

ELLIS (ĕl'lĭs), **George Edward,** historian and author, born in Boston, Mass., Aug. 8, 1814; died Dec. 21, 1894. He graduated at Harvard and studied at the Divinity School, and was ordained a minister. In 1840 he became pastor of the Harvard Unitarian Church at Charlestown, Mass., and was professor of systematic theology in the Harvard Divinity School in 1857-63. He contributed to many periodicals and published a number of books, principally biography and history. His writings include "Memoirs of Jared Sparks," "Half Century of Unitarian Controversy," "History of the Battle of Bunker Hill," and "The Puritan Age and Rule in the Colony of Massachusetts."

ELLSWORTH (ĕlz'wûrth), **Ephriam Elmer,** soldier, born in Mechanicsville, N. Y., April 13, 1837; died May 24, 1861. He removed to Chicago at an early age and became colonel of a zouave regiment organized by him from volunteer firemen of New York. He was stationed at Alexandria, Va., where he was shot and killed by a hotel keeper while in the act of tearing a Confederate flag from the building. The people of the North regarded him the first martyr of the Union cause, and he was buried with military ceremonies from the White House, in Washington.

ELLSWORTH, Oliver, statesman and jurist, born in Windsor, Conn., April 29, 1745; died Nov. 26, 1807. He studied at Yale and Princeton, was admitted to the Connecticut bar, and in 1775 became a member of the Connecticut Legislature. He was elected to the Continental Congress in 1778, where he distinguished himself in state affairs and as an advocate of the American cause. In 1787 he was chosen to represent his State in the Constitutional Convention, in which he advocated a Congress of two houses, the upper based upon equality between the states and the lower to be constituted of representatives according to population. He was elected United States Senator in 1789, and in 1796 became Chief Justice of the Supreme Court, serving until 1799, when he was made a commissioner to settle disputes between France and the United States.

ELLWOOD (ĕl'wo͝od), **Thomas Crowell,** author, born in Oxfordshire, England, in 1639; died Mar. 1, 1713. He became a minister of the Society of Friends. In 1662 he was chosen reader to Milton, who is said to have written "Paradise Regained" on the suggestion of Ellwood. His writings include a number of controversial works and several biographies. They include "Forgery on Christianity," "Autobiography," "Sacred Histories of the Old and New Testaments," and a poem entitled "Davideis."

ELM, a genus of trees which includes thirteen well-marked species, all native to the North Temperate Zone. In most species the branches are numerous and spreading, the bark is rugged, and the leaves are alternate, ovate, and doubly serrate. The flowers are small, but numerous and in clusters, and the fruit is either a small, one-sided nut, forming a winged samara, or a drupe. Elm wood is compact and very durable in water. The trees commonly grow to the height of 60 to 100 feet, and in some cases as high as 150 feet. Wagon hubs and ship locks are made of the wood of the white elm, which is also largely taking the place of oak in the manufacture of the cheaper grades of furniture. The *slippery* or *red elm,* a native tree of America, contains a mucilaginous inner bark, while the *wych elm,* or *wych hazel,* is indigenous to Europe. Another species is the *weeping elm,* which is the most ornamental of the genus. The old white elm tree of the Boston Commons, destroyed by a storm on Feb. 15, 1876, measured 22 feet in circumference. See illustration on following page.

ELMIRA (ĕl-mī'rà), a city of New York, county seat of Chemung County, on the Chemung River. It is on the Pennsylvania, the Lehigh Valley, the Erie, and the Lackawanna railroads and is the focus of several electric lines. The streets are regularly platted, crossing each other at right angles, and are improved by grading and paving. Among the noteworthy buildings are the post office, the courthouse, the public library, and the city

hall. The public school system culminates in an excellent high school course and is supplemented by Elmira College, an institution having an endowment of $250,000. Among the charitable institutions are an industrial school, an orphanage, a home for the aged, the Arnot-Ogden Memorial Hospital, and the Anchorage. It is the seat of the State reformatory.

Elmira is important as a market and an industrial center. The manufactures include clothing, silk and woolen goods, engines and boilers, boots and shoes, steel plate, cigars, and machinery. It was settled in 1788 and incorporated in 1815. During the Civil War it had a Federal prison in which many Confederates were confined. Population, 1925, 48,359.

ELMO'S FIRE, Saint, the popular name of a meteoric appearance seen during thunder storms at the tops of masts and other pointed objects. It is more frequent in southern than in northern climates, and is due to currents of electricity. It appears either as one or two flames. The former phenomenon, known as Helena, is regarded a bad omen by sailors, while the latter, called Castor and Pollux, is looked upon as a good sign.

ENGLISH ELM. SLIPPERY ELM.

ELORA (ĕl-lō′rä), or **Ellora,** a village of Hindustan, near Dowlatabad, celebrated on account of its remarkable temples hewn in rocks. These temples number about 35, some of which are cave temples, while others consist of excavations in higher strata of rock. Many of the larger structures are about 150 feet wide and 275 feet long, and are adorned by sculptures, sphinxes, and obelisks cut from solid granite. The caves are thought to have been constructed in the 7th century.

EL PASO (ĕl pä′sō), a city of Texas, county seat of El Paso County, on the Rio Grande. It is on the Southern Pacific, the Mexican Central, the Texas Pacific, and the Atchison, Topeka and Santa Fé railroads. The site is 3,839 feet above sea level, with a mean annual temperature of 63° Fahr., and the surrounding country has large interests in stock raising and general farming. Among the noteworthy buildings are the county courthouse, the high school, the Hotel Dieu, the Federal building, and several private schools and hospitals. The streets are well paved and drained. It has a sewer system, gas and electric lighting, and electric street railways. The industries include smelting, refining, packing, and machine shops. El Paso was settled in 1827 and incorporated in 1869. Near the city is a United States military post. Population, 1900, 15,906; in 1920, 77,543.

EL RENO, county seat of Canadian County, Oklahoma, on the Canadian River, 25 miles west of Oklahoma. It is on the Chicago, Rock Island and Pacific and other railroads. The surrounding country is fertile. Among the chief buildings are the high school and the county courthouse. It has manufactures of flour, earthenware, and machinery. The city maintains a system of waterworks and has electric lighting. Population, 1920, 7,737.

ELVES, the term applied to the mythical spirits supposed to inhabit wild and desolate places, and in various ways to exercise a mysterious power over man. See **Fairies.**

ELWOOD (ĕl′wo͝od), a city of Indiana, in Madison County, 37 miles northeast of Indianapolis. It is on the Pittsburg, Cincinnati, Chicago and Saint Louis, the Pennsylvania, and other railways. Natural gas is obtained in the vicinity. The chief buildings include the county courthouse, the high school, and the public library. It has gas and electric lighting and electric street railways, and is a growing market for cereals and live stock. The manufactures include glass, machinery, tin plate, and clothing. The municipality maintains systems of sewerage and waterworks. Population, 1900, 12,950; in 1920, 10,790.

ELY (ē′lĭ), a town in the county of Cambridge, England, on the Ouse River. It has a superb cathedral founded by Etheldreda, daughter of the King of East Anglia, about the year 673. This building was burned by the Danes in 870, rebuilt as a Benedictine abbey in 970, and greatly enlarged after the first Norman conquest. It includes different parts which are built in the various styles of architecture that prevailed in Britain from the Conquest to the Reformation, is 517 feet long, and has a tower 275 feet high. The town is surrounded by a gardening district which produces vegetables for the markets of Cambridge and other cities. It was the last stronghold of the Saxons after the Conquest. Population, 1922, 8,471.

ELY, Richard Theodore, political economist, born in Ripley, N. Y., April 13, 1854. He studied at Dartmouth and Columbia colleges, took advanced courses at Heidelberg, Germany, and was professor of political economy at Johns Hopkins University in 1885-92, after which he

secured an appointment as professor of political economy in the University of Wisconsin. He is recognized as one of the leading authorities on economic questions in the United States, and is the author of many books on political and social questions. Some of his theories have been criticized as antagonizing much that is desirable in our social system. However, from these charges he was exonerated officially by the authorities of the University of Wisconsin. Among his best known works are "French and German Socialism of Modern Times," "Labor Movement in America," "Recent American Socialism," "Co-öperation in America," "Introduction to Political Economy," "Socialism and Social Reforms," "Taxation in American States and Cities," "Social Aspect of Christianity," and "Monopolies and Trusts."

RICHARD T. ELY.

ELYRIA (ĕ-lĭr'ĭ-ȧ), county seat of Lorain County, Ohio, about seven miles south of Lake Erie, on the Black River. It is on the Baltimore and Ohio and the New York Central railroads, in a prosperous section, and is surrounded by an agricultural country. The chief buildings include the county courthouse and the public library of 17,500 volumes. Sandstone is quarried in the vicinity and shipped in large quantities. The manufactures include clothing, cheese, tobacco, machinery, and confectionery. It has pavements, electric lighting, and a large trade in produce. Population, 1920, 20,474.

ELYSIUM (ĕ-lĭzh'ŭm), or **Elysian Fields,** in mythology, the place in which the souls of the blessed were supposed to dwell after death. The Orientals and most other peoples considered this abode to be in the upper regions of the sky, but the Greeks located it in the west, or beneath the earth, where the sun goes down. Homer described it as the Isle of the Blessed, where men live without toil or care, where snow and winter's storms are unknown, where the lovely and cooling zephyrs blow unceasingly with light murmur, and where the favorites of the gods are carried when passing from this life. He thought that Rhadamanthus, the most just of men in the upper world, alone ruled Elysium. Hesiod speaks of the happy isles of the ocean, but Pindar and the later poets put it beneath the earth.

ELZEVIR (ĕl'zę-vĭr), the name of a celebrated family of Dutch printers, famous for their editions of classical and historical works. Louis Elzevir founded the reputation of the family as printers in 1583, and he was succeeded by his seven sons. Abraham Elzevir (1681-1712), university printer of Leyden, is the last of these celebrated printers. The books issued are noted especially for the fine grade of paper and elegance of the types. They include 10 in Italian, 11 in German, 32 in Flemish, 44 in Greek, 126 in French, and 968 in Latin.

EMANCIPATION (ĕ-măn-sĭ-pā'shŭn), the liberation from bondage, applied in American history especially to the release of the negroes from slavery. The early constitution framed in Vermont abolished slavery in 1777 and Massachusetts did likewise in 1780. Acts of gradual emancipation were passed by Pennsylvania in 1780, New Hampshire in 1783, Rhode Island in 1784, Connecticut in 1784, New Jersey in 1804, and New York in 1799, though in the last-mentioned State an act of absolute emancipation took effect July 4, 1827. Slavery was permitted in the remainder of the colonies, and in the case of new states the question was settled at the time of admission. Soon after the Civil War commenced President Lincoln was urged by northern abolitionists to abolish slavery by proclamation. As early as 1862 laws were passed abolishing slavery in the territories, freeing escaped slaves of persons in rebellion, and abolishing slavery in the District of Columbia, the owners receiving compensation.

The Northern States entered upon the war to maintain the Union, not to liberate slaves. On Aug. 22, 1862, President Lincoln stated: "My paramount object is to save the Union, and not either to save or destroy slavery. If I could save the Union without freeing one slave I would do it; if I could save it by freeing all the slaves I would do it; and if I could save it by freeing some and leaving others alone I would do that." As the war progressed it became evident that slavery was a source of much military strength to the seceded states, and freeing them was decided on as a war measure. President Lincoln issued a proclamation on Sept. 22, 1862, in which the seceded states were notified that unless they returned to their allegiance by Jan. 1, 1863, he would declare their slaves forever free. Since the states in rebellion did not heed the notice, the Emancipation Proclamation followed on Jan. 1, 1863, by which all slaves in these states were declared free. It was given effect as rapidly as the Federal troops secured control of the territory held by the Confederates. In the proclamation the President declared it an act of military necessity, enjoined the freed slaves to abstain from violence, and offered to engage them in the military and naval service.

EMANUEL I. (ĕm-ăn'ū-ĕl), King of Portugal, called the Great, born May 3, 1469; died Dec. 13, 1521. He succeeded John II. in 1495 and at once entered upon a vigorous reign, which became known as the golden age of Portugal. The code of laws that bears his name was prepared by him, under which edu-

cation was extended and internal improvements were fostered, and Portugal was made the first naval power of Europe, as well as the commercial center of the world. It was in his reign that Vasco da Gama sailed round the Cape of Good Hope and made valuable discoveries in India, while Cabral was dispatched on the expedition in which he discovered Brazil, and Albuquerque and other noted navigators added valuable foreign territory. At the time of his death Portuguese colonies, military strength, commercial enterprise, and internal improvements were at their highest state of prosperity.

EMBALMING (ĕm-bäm'ing), the art of preserving the dead bodies of men and animals. There are many evidences that the art was practiced extensively in ancient Egypt, where the process was known at least 4,000 years B. C., this being evidenced by the embalmed bodies of Cheops and other sovereigns of the early dynasties. The origin of embalming is ascribed by the Egyptians to Anubis, who embalmed his father, Osiris. One of the earliest records of embalming is that of the patriarch Jacob. We learn from reliable sources that the body of Joseph was thus prepared and transported out of Egypt. The practice prevailed, though not so extensively, among the nations of Asia and in Greece and Rome. Usually the bodies of the poorer classes were dried in the sand or washed in myrrh, and then salted for a period of seventy days.

Embalming among the middle classes consisted of removing the brain and soaking the corpse in a solution of natron, which destroyed the viscera and soft portions, leaving practically only the skin and bones. The wealthy frequently paid $3,000 for the embalming of a single body, the process being nearly the same as among the middle classes, except that the corpses were swathed in linen bandages saturated with gum, and perfumed with aromatic substances. Within and about the bodies of different mummies have been found sulphate of soda, saltpeter, salt, soda, oil of cedar, turpentine, asphalt, myrrh, and cinnamon. Extended knowledge of the use and effect of chemicals has led to the employment of various compounds that are effective in artificial embalming, such as arsenic, sulphate of zinc, corrosive sublimate, and spirit compounds. They are forced into the blood vessels and cavities soon after death ensues, or the body is immersed for some time in spirits. At present the corpses are embalmed chiefly to prevent contagion, to make transportation less dangerous, and to overcome the necessity of immediate burial. See **Mummy**.

EMBARGO (ĕm-bär'gō), a prohibition by government authority of the departure of ships or merchandise from some or all its ports. It is either *hostile* or *pacific*, the former having reference to the detention of vessels of a foreign country and the latter to its own vessels. A hostile embargo is declared either as a means to settle a dispute or to make a reprisal, while a pacific embargo is laid as a public policy or to protect the merchant vessels of a neutral nation. The first general embargo was laid by the United States in 1794. It was effective upon all vessels for sixty days, and was laid as a retaliatory measure against the British orders in council dated June 8, 1793. At the time of the War of 1812 another embargo was laid, in 1813.

EMBER DAYS, certain days in each of the four seasons set apart for prayer and fasting, one theme for supplication being that the blessings of God may descend on the crops. They are the Wednesday, Friday, and Saturday after the first Sunday in Lent, after Whitsunday, after the 14th of September, and after the 13th of December.

EMBOSSING (ĕm-bŏs'ĭng), the art of producing raised figures upon plain surfaces, such as paper, leather, bronze, and wood. In the two last mentioned the figures are said to be in *alto-*, *mezzo-*, or *bas-relief*, according to whether they are more or less prominent. Paper, leather, and the textile fabrics are embossed by powerful presses, in which the dies give their pattern to the object to be embossed. Steam is employed to keep the plate at a suitable temperature, depending upon the material to be embossed, and the power is applied by a treadle to straighten a bent arm, as in the old form of the printing press. Wood to be embossed is softened by steam and the impressions are made by iron molds into which it is forced. Metal is embossed largely by hand, the workman beating it up from the under side, and this method is called *repoussé work*. In embossing textile fabrics, it is done largely as needle work embroidered over figures padded with various materials, such as wool felt.

EMBROIDERY (ĕm-broid'ĕr-ў), the name applied to ornamental needlework produced upon fabrics of any kind. Its production was one of the most important of the early arts in Oriental countries, and it is still practiced with much skill and diligence, the best work being done upon silk. The figures are either in colored silk or in threads of silver and gold. They consist of men, horses, dragons, etc., and are outlined with gold and filled with shades of silk, though sometimes are ornamented with beads, spangles, pearls, and precious stones. The fabric is stretched usually on a frame, with the design to be worked drawn upon it, or some other contrivance is used to guide the worker.

From the earliest times embroidery has been used to decorate the sacerdotal vestments, but it likewise has served other ecclesiastical uses. In modern times it has been employed to a large extent in women's dresses and undergarments. The Jews derived their skill in producing embroidery from the Egyptians. It ap-

pears to have been a common art, since even barbarous tribes were skilled in making showy designs upon cloth and other fabrics, using both linen and wool for the purpose. Many of the nomadic tribes of Asia and Africa still practice it as a domestic art. The process of doing embroidery work, even in modern times, employs simple tools and the work is largely by hand. They consist chiefly of needles of different sizes and scissors to cut the thread. The thread left on the surface of the cloth after each ply of the needle is called a *stitch.* The stitches differ in accord with the work to be done and include principally those known as the cross, darning, running, crewel, feather, rope, cushion, buttonhole, chain, canvas, and couching stitches. Various machines for making embroidery are now in use.

EMBRYOLOGY (ĕm-brĭ-ŏl'ŏ-gў), that branch of biology which treats of the formation of organisms. The study of this division of learning as a science dates from the last century, though Aristotle, Galen, and Harvey considered the subject and laid the foundation for the recent embryologists. The epoch of life in placental mammals, to which the study of embryology ordinarily is limited, extends from the time of conception to the period at which the anatomical connection between the young and mother is severed, though in a general sense it embraces the entire period from conception to the attainment of the perfect form. By *conception* is meant the *fertilization* of the ovum, which takes place through a spermatozoön, or male germ cell, penetrating into it, both in animals and plants. However, there are radical distinctions that give rise to divers limitations.

In most fishes and some other animals the embryo and parent have no anatomical connection, while fertilization of the ovum in many of these is effected outside the female. In oviparous animals the female retains the ovum within the body for some time after fecundation, where it is retained in a condition largely independent of the maternal body, though securing from it heat and protection. After a definite number of eggs have been ejected, the mother begins external incubation, which is continued until the young life bursts from the shell. However, a filial relationship exists after incubation by reason of which the new life is supplied with protection and food, while in other animals the lacteal function of the mother supplies the helpless young with support quite as vital as the nourishment previously extended through the placenta.

The laws announced by Rudolf Virchow (q. v.) and Karl Ernst von Baer (1792-1876), two German scholars, form the basis of study in modern embryology. The laws of the former imply that the organs and cells of new life forms originate primarily from cells deposited in the ovulum and gradually become complex through cell divison and cell specialization, or the physiological division of labor. Von Baer's law maintains that the form primarily assumed by an individual in the process of development is similar to that assumed by many types, later its organism becomes more specialized and, when fully developed, stands wholly apart from parallel types. Thus, the process of development leads to the special from the general, to the heterogeneous from the homogeneous.

Herbst explains the whole process of embryonic development by asserting that the protoplasm responds in a very intricate way to its surroundings; that it depends upon physiological responses to stimulations that come from without; in other words, that the cells and organs in the embryo move and change form in response to various stimuli, especially in eggs containing a considerable quantity of yolk. The yolk being food for the embryo, it is certain that the latter gives off waste products in the process of rapid growth, and later moves away to portions of the yolk not contaminated by such wastes.

It is quite well known that the development of the embryo differs materially in different animals, though in the successive stages there is much analogy, even in the human foetus, to the embryo or adult of the lower life forms. However, in this connection arises the discussion of the theories of *evolution* and *epigenesis.* According to the former theory the embryo exists preformed in the ovum and begins to unfold into the adult as soon as fecundation takes place; while in the latter we find the theory that holds the growth of the embryo to be a process of new formation, the cell mass giving birth to new cells in their own interior by stimulation from without, a view now most generally adopted.

EMERALD (ĕm'ĕr-ąld), a variety of beryl, being distinguished in having an emerald-green color, in place of pale green, light blue, yellow, or white hues, which are the colors of the beryl. The emerald green of this gem is produced by the presence of chromium. Jewelers obtain the finest emeralds from Peru, but fine species are found in other places of South America, and an inferior quality is native to Europe. The emerald is usually in the form of a prism, and is most valuable when the surface is perfectly straight and smooth, so as to cast no darkening shadow on any of its particles. It is one of the softest of the precious stones, but acids will not affect it. Emeralds are cut on a copper wheel with emery dust, and polished on a tin wheel with rotten stone. As a gem it is considered inferior only to the diamond and ruby.

EMERALD ISLE, the popular name of Ireland, applied to it on account of the rich green color of its vegetation. It came into general use through Dr. Drennan (1754-1820), who first used it in his poem entitled "Erin."

EMERSON (ĕm'ĕr-sŭn), **Ralph Waldo**, essayist, philosopher, and poet, born in Boston, Mass., May 25, 1803; died April 27, 1882. He came from a family which had resided in America for three generations, his parents being William Emerson and Ruth Haskins. The greater part of his boyhood was passed in Boston. He graduated at Harvard College in 1821 and later studied theology under the direction of Channing. Soon after he was made pastor of the Second Unitarian Church, Boston, but severed his connection after a brief period on account of holding views respecting the Lord's Supper at variance with his congregation, and afterward he devoted himself to writing and lecturing. He married Ellen Louisa Tucker in 1832, but she died the following year, and he spent two years in Europe, largely with the view of recuperating his health. While in England he became acquainted with Wordsworth, De Quincey, Coleridge, and Carlyle, forming with the last mentioned a personal friendship that influenced the lives of both. In 1835 he married Lidian Jackson, and settled in Concord, Mass., where he made his permanent home, leaving it only when on lecturing tours and for a second visit to Europe.

RALPH WALDO EMERSON.

The life of Emerson was largely that of a literary recluse, owing to the close attention he gave to study and research. His knowledge of the practical affairs of public life was comparatively limited, though he possessed considerable interest in public questions, while his philosophy lacked robustness and thought, at least such as the busy life of his time required. His essays are characterized by charming ideals and ethical beauty. These, together with a wise choice of words, originality in thought, and inspiring tendency, have made for them a permanent place in modern literature. The total collection of Emerson's works embraces twelve volumes, including philosophical and religious writings, poems, essays, and lectures. His lectures include several which relate to the abolition of slavery. Among his best known and popular writings are "Representative Men," "The American Scholar," "Memoir of Margaret Fuller," "Oration on the Death of Lincoln," "Society in Solitude," "Conduct of Life," "Nature: An Essay," "Letters and Social Aims," "May Day and Other Pieces," and "English Traits." With these should be classed "Letters to Thomas Carlyle," a series of letters published posthumously.

EMERY (ĕm'ĕr-ỹ), a variety of corundum, being allied to the sapphires, the ruby, and other precious stones. It is granular in texture and the hardest substance found native, next to the diamond. Emery is a dense, opaque, dull grayish-black substance, occurring in bowlderlike masses and as granulates in soils. It is found in the islands of the Greek Archipelago, in Asia Minor, at Chester, Mass., and elsewhere. As a powder it is used extensively for cutting and polishing precious stones and for smoothing the surfaces of lenses and plate glass. When employed in this form, it is prepared by first breaking the stone into small lumps, then crushing them into powder by stampers. Emery paper and emery cloth are made by sifting the powder over strong sheets of paper or cloth, after brushing them with liquid glue. Emery wheels are commonly made of wood covered with leather or coarse cloth, with a surface of emery, or a compound of emery and caoutchouc molded into the shape of a grindstone and vulcanized.

EMIGRATION (ĕm-ĭ-grā'shŭn), the removal from one country or region for the purpose of settling or residing in another. Inhabitants leaving a country are called emigrants, while those coming into a country or state are spoken of as immigrants. Among the principal causes that have led to emigration are over-population, political and social discontent, compulsory military service, religious persecution, the desire to attain greater liberty, and the general betterment of industrial conditions. The barbaric tribes of ancient times were induced to migrate and occupy territory more conducive to their arts of warfare and life, while civilized people have migrated more or less for higher purposes, especially to carry the benefits of civilization and religion to remote lands. All of Europe was settled by the over-population that pressed westward from Asia, and later, when the population of European countries became dense, the inhabitants in turn sought newer lands and greater opportunities. The fact that people are governed by certain laws of migration, such as passing to countries having a similar climate, the same natural resources, and an approximately equal altitude, has been well established.

Emigration to America on a large scale began with the departure of the Puritans, who planted colonies in New England. Soon after the Dutch colonized New York, the Germans settled Pennsylvania, the French occupied Canada and Louisiana, the Spaniards made settlements in Florida, and the Swedes established a foothold in Delaware. In 1815 such an extensive breaking-up occurred in Europe that alarm was occasioned, though afterward it became manifest that the emigrants were made up largely of the over-population of various countries. The last century marks the greatest epoch of migration in the world's history, a period in which the

Spanish and Portuguese languages were planted in Central and South America, the English in North America and Australia, and the Dutch, English, German, and French in various portions of Africa, Asia, and the Oceanic islands. Perhaps the planting of language is even overshadowed by the establishment of certain forms of religion, industries, and customs, and the molding of a new civilization. The colonial policy pursued in recent years by the great powers of Europe is tending to direct the overpopulation to various colonies, and thereby to strengthen more and more the foothold that these nations have in regions far remote from the mother country. This is particularly true of the Russians in Asia, and the Portuguese, French, Belgians, English, and Italians in Africa.

ÉMIGRÉS (ā-mē-grā′), the name given to the royalists who fled for safety from France during the Revolution of 1789. The movement began shortly after the storming of the Bastile on July 14, 1789, When Prince Condé became alarmed at the course of events and was joined by many nobles in emigrating to Germany and the Netherlands. In October of the same year a concerted attack was made on Versailles, causing the royal family to remove to Paris, and this was followed by a renewal of emigration on a larger scale. The *émigrés* collected an army of 80,000 men at Coblentz under the Duke of Brunswick and the king made a disastrous attempt to join the forces, but was captured on the night of June 20, 1791. Condé and his adherents joined the Prussian army in Champagne, which caused the French government to confiscate their property and to proclaim the death penalty upon many for treason. When Napoleon gained the consulship, they were permitted to return, but the charter of 1814 made it impossible for them to regain their estates or former privileges. In 1825 the government voted to compensate them for the loss of their estates, but this was annulled as a result of the Revolution of that year.

EMINENT DOMAIN (ĕm′ĭ-nẹnt dō-mān′), the supreme right possessed by a country or state to take or control private property for public use without the consent of the owner. This right is justified in all civilized nations because it serves to promote the general welfare. It is not a confiscation of the property, since it is required that full and adequate compensation be made to the owner, and is to a large extent the outgrowth of the feudal system of land tenure in England and elsewhere. The Parliament of Great Britain provides for reasonable compensation to the owner of property taken for public use, but this is done rather as an act of justice than because of legal obligation. In the United States it is a constitutional requirement that no person shall be deprived of property without due process of law, and "private property shall not be taken for public use without just compensation." Nearly all of the states have similar constitutional provisions, and under them, or the statute laws, property may be taken for public use in the same way as it may be taken by the national government. The right of eminent domain is essential and necessary, since otherwise it might become impossible to construct public buildings, highways, canals, and railroads.

EMIN PASHA (ā′mēn pä-shä′), African traveler, whose real name was Eduard Schnitzer, born at Oppeln, Germany, in 1840; slain Oct. 20, 1892. He was educated at Neisse, studied medicine in Berlin, and went to Turkey in 1864, where he became successful as a physician. After learning Arabic and Turkish, he adopted Turkish habits and customs, and assumed the name of Emin, meaning the "Faithful One." Later he accompanied Hakki Pasha on official expeditions through Armenia, Syria, and Arabia, became attached to Ismail, governor of Scutari, and, after the death of the latter, married his widow. He joined the Egyptian service as chief physician in 1876, and two years later was appointed governor of a province by General Gordon. Soon after the troops of the Mahdi cut off his means of communication and surrounded his forces, though he defended himself until an expedition under Stanley came to his relief in the spring of 1888. The following year he was taken prisoner by the natives, but escaped and entered the German service. In 1892 he undertook an expedition to the Congo, where he was captured and murdered. Many European countries bestowed distinguished honors upon him for valuable service in African research.

EMMET (ĕm′met), **Robert,** revolutionist, born in Dublin, Ireland, in 1778; executed Sept. 20, 1803. At the age of fifteen years he entered Trinity College, Dublin, where he was a fellow of Thomas Moore, the poet, and was expelled in 1798 on account of having connected himself with the Association of United Irishmen. Soon after he traveled in Europe, consulted with Tallyrand and Napoleon regarding the Irish cause, and planned a general revolution, devoting his own fortune of $15,000 for the purchase of munitions of war. He attempted to seize the arsenal and castle of Dublin on July 23, 1803, but the attempt failed, his men dispersing after the first volley had been fired. He escaped in safety to the Wicklow Mountains, but, contrary to the advice of his friends, he insisted on visiting Sarah Curran, daughter of the celebrated barrister, and was apprehended. The speech made in his own behalf at the trial on the charge of high treason is remarkable on account of its eloquence, though he was convicted and hanged. Thomas Moore commemorated his fate by writing "O, Breathe Not His Name," while he perpetuated the memory of Miss Curran, who died in Sicily soon after Emmet's execution, by writing "She

is Far from the Land Where Her Young Hero Sleeps."

EMMETT, Daniel Decatur, musician and author, born in Mount Vernon, Ohio, Oct. 29, 1815; died June 29, 1904. He descended from a family which is prominent in the record of American wars, his grandfather having served in the Revolutionary War and his father in that of 1812. He learned to play the violin at an early age, became accomplished on several instruments, and acted with a number of minstrel troops. In 1859 he composed the celebrated song, "Dixie Land," which, during the Civil War, attained a popularity among the Confederates equaled only by "John Brown's Body" among the northern soldiers. This famous air is as popular now as when it was written, and touches the emotions in foreign lands quite as effectually as on the American continent. Other publications include "The Road to Richmond," "Old Dan Tucker," and "Walk Along, John."

EMOTIONS (ē-mō'shŭns). See **Feelings.**

EMPEDOCLES (ĕm-pĕd'ō-klēz), Greek philosopher, born at Agrigentum, Sicily, flourished about 435 B. C. He descended from a distinguished family and is regarded a great poet and public benefactor. According to his theory the world is compounded of four primary elements; that is, air, fire, earth, and water. He thought that there are two forces, hate and love, which he considered repulsive and attractive. His chief work is entitled "Nature," which is a poetic treatment of cosmology and psychology. It is related that he threw himself into the crater of Mount Aetna to immortalize himself, but this is likely a fable.

EMPEROR (ĕm'pēr-ēr), the title of a sovereign who rules over an empire, considered superior to the rank of a king. It originated from the title of *Imperator,* which was conferred by the ancient Romans on the consuls in their military capacity. In later times it designated the highest authority in the state and Julius Caesar assumed this title and made Rome an empire. Charlemagne, who founded the German Empire, received the title of Emperor of the Romans in 800 A. D., and it was borne by his successors until 1806, when the Holy Roman Empire was dissolved. At present it is the official title of the emperors of Japan and Abyssinia. The King of England is Emperor of India, and the Shah of Persia is frequently alluded to as an emperor. Persia, Japan, and Turkey are empires.

EMPIRICISM (ĕm-pĭr'ĭ-sĭz'm), a system of practice based on the results of observation rather than on the scientific investigation of principles. It is evident from the very nature of progress in the learned professions that the early methods employed were more largely empirical than after material advancement had been made, though the value of any system of learning depends to a large extent upon practical observations based upon successful and continuous experiments. In the greater activities of modern civilization scholars aim to take advantage of every useful discovery and method made in previous ages, and, by a system of continuous investigation, to supplement such newer and advancing methods as are evolved in consequence of thorough application. From this it is evident that all methods are to take into account the benefits of systems originated in the past, and to further accumulate and enlarge by experience and observation.

EMPORIA (ĕm-pō'rĭ-à), county seat of Lyon County, Kansas, on the Neosho River, 120 miles southwest of Kansas City. It is on the Kansas City Southern and the Atchison, Topeka and Santa Fé railroads. The surrounding country is a fertile farming region. Among the chief buildings are the county courthouse, the Carnegie library, a conservatory of music, and the College of Emporia, a Presbyterian institution. It is the seat of a State normal school. The manufactures include clothing, ironware, machinery, flour, dairy products, and works in marble. It has several concrete highways, waterworks, and gas and electric lighting. Emporia was settled in 1856 and incorporated in 1870. Population, 1925, 12,243.

EMS (ăms), usually called the Bath of Ems, a bathing place of Germany, about four miles from Coblentz, on the Lahn River, in the province of Hesse-Nassau. The thermal springs belong to the class which contain soda, have a temperature of 78° to 135°, and the waters are used both for drinking and bathing. It has numerous bathing establishments, many of which are finely constructed. The town is noted for its fine hotels, theaters, and private lodging houses. Thousands of visitors throng the place annually. The value of the springs was known to the Romans. Population, 1922, 7,614.

EMU (ē'mŭ), or **Emeu,** a large bird closely allied to the cassowary, standing from five to six feet high. It is native to Australia and the adjacent islands. The color is a dull brown mottled with gray-white, but the young are striped with black. The head is devoid of a helmet, as found in the cassowary, and the bill is depressed. Australian natives value the flesh and eggs for food, the former having a taste which resembles that of beef. Emus are easily domesticated and breed readily in that state. The eggs are not as large as those of the ostrich, being only about four inches in diameter, but require three months for incubation, which is sometimes performed by the male. They live on roots, fruits, and herbage. The only sound uttered is a loud, booming cry made by the female. This species of birds is unable to fly, but it possesses much speed in running. See illustration on following page.

EMULSION (ē-mŭl'shŭn), a medical preparation composed of a soft liquid resembling milk in consistency and color, its oily or resinous property being united with water by a sac-

charine or mucilaginous substance. Among the best known is the emulsion of cod-liver oil, used in treating pulmonary disease.

ENAMEL (ĕn-ăm'ĕl), the name given to vitrified substances of various composition, applied to the surface of metals. It is generally put on like paint, with a brush, and then heated sufficiently to melt the enamel, which causes it to become a fixed part of the surface. The art was practiced by the Egyptians and Etruscans on pottery, and passed from them to the Greeks and Romans. In Western Europe, especially among the Saxons and Normans, it was early employed in manufactures. It is used for producing artistic designs, figures, and

CASSOWARY. EMU.

ornaments, when it belongs to the fine arts, and is employed in making the dial plates of watches and clocks and for coating culinary vessels. The basis of all enamels must be an easily fusible, colorless silicate or glass. All bases on which it is applied must be cleaned with weak acid, or some similar preparation, and moistened with gum water. Copper is the best base, but iron is used for ordinary purposes.

ENAREA (ā-nā'rē-ā), a region of Africa, in the southern part of Abyssinia, between 7° and 9° north. It is inhabited by natives of the Gallas tribes. The government is hereditary and absolute. Among the chief products are coffee, cloth, embroidery, gold, live stock, and fruits. In religion the people are largely Mohammedans. The slave trade is still sanctioned, though it has been abridged greatly in recent years. The government is administered from Saka, a city near the Gibbe River. Population, 1922, 42,500.

ENCAUSTIC PAINTING (ĕn-kąs'tĭk), the method of fixing colors upon objects by the process of burning. The ancient Greeks employed the encaustic art in decorating the inner and outer walls of buildings and in ornamenting sculptures in marble. It was a common kind of painting among the artists of Rome during the empire. The colors were mixed with wax and resin, and the pictures were finished by the application of a hot iron, hence it gave the product a more glossy surface than that obtained in water-color painting. It has the advantage of being very enduring, hence the art has been revived to some extent. Polygnotus's "The Battle of Marathon" is a good example of encaustic painting and was preserved in an open portico at Athens about ten centuries.

ENCYCLOPAEDIA (ĕn-sī-klō-pē'dĭ-ā), **Encyclopedia, or Cyclopaedia,** a work in which the various branches of science and art are treated separately, or in particular departments, and usually in alphabetical order. The authors of early encyclopaedias attempted to treat all subjects of human knowledge exhaustively, but, as knowledge extended, vocabularies enlarged, and specialists multiplied, it became necessary to confine the treatise to a smaller limit of subjects or make the work departmental and specialized. It is assumed that Terentius Varro wrote the first extensive work of an encyclopaedic nature in the year 30 B. C. Pliny the Elder soon after prepared his well known "Natural History," which long ranked as a highly superior work. Farabi, an Arabian writer, prepared an encyclopaedia in the Arabian in the 10th century, while Dominican Vincent of Beauvais, under the patronage of Louis IX. of France, collected the whole sum of knowledge of the Middle Ages, to which an anonymous author appended a valuable addition several years later. In 1677 Johann Jacob Hoffman published his great German work, "The Universal Lexicon,' at Basel, Switzerland, and in 1697 Pierre Bayle, the French critic, issued his well-known "Dictionary of History." The most extensive of the newer German works are Meyer's "Neues Konversations-Lexikon" and Brockhaus's "Konversations-Lexikon." Ange de Saint-Priest's "Encyclopédie du XIXème siècle" is a modern work in French.

The first English encyclopaedia containing subjects in alphabetical order was the "Lexicon Technicum" published in 1704. Among the newer English works are the "Encyclopaedia Britannica," published at Edinburgh in 1788, Charles Knight's "Penny Encyclopaedia," and "Chambers' Encyclopaedia." The English publications have been revised from time to time and have had a large sale in America. To make them more suitable in Canada and the United States, American supplements or additions have been combined with the English publications. The most extensive encyclopaedia ever published in the world is the Chinese "Encyclopaedia of Literature and Science," containing 5,040 volumes. It embraces information on practically every subject known to the people of the Celestial Empire. Among the leading American publications are "The Americana,"

"Johnson's Universal Cyclopaedia," and "The New International Encyclopaedia." Besides these are smaller editions of general character and numerous works treating on special subjects, such as biography, anatomy, ethnology, zoölogy, etc.

ENDICOTT (ĕn'dĭ-kŏt), **John,** Colonial Governor of Massachusetts, born at Dorchester, England, in 1589; died in Boston, Mass., March 15, 1665. He came to America in 1628, took charge of the plantation at Naumkeag, now Salem, and exercised the chief authority until John Winthrop was appointed Governor, in 1630. He was Deputy Governor of the Massachusetts Bay Colony in 1641-44, and served as Governor from 1644 till 1665, except only several intervening years. Among the early Puritans he ranks as a fearless and energetic leader in public and social life. He established the first mint in the colony, removed the cross of Saint George from the military standard, opposed the practice of wearing long hair, insisted upon women wearing veils at public assemblies, and was instrumental in executing four Quakers. It is related that he was universally respected as a kind and brave man, though he is said to have had a high temper.

ENDICOTT, William Crowninshield, statesman, born in Salem, Mass., Nov. 19, 1827; died May 6, 1900. He descended from the family of Governor John Endicott, graduated at Harvard University in 1847, studied law for three years, and in 1850 was admitted to the bar of Massachusetts. After pursuing a highly successful practice, he secured an appointment, in 1873, to the Massachusetts supreme court, but resigned in 1882 on account of impaired health. President Cleveland selected him as Secretary of War for his first administration, and as such he distinguished himself by efficient service. Joseph Chamberlain, of England, married his daughter.

ENDOGENS (ĕn'dŏ-jĕns), one of the two primary classes of plants into which the vegetable kingdom is divided, the other being exogens. This designation of character is determined from the structure of the stem, which has the wood in threads mixed with the pith and scattered throughout every part, never forming layers, and from the wood of which the bark cannot be peeled, because of its being partly developed in the interior of the stem. The embryo has but one cotyledon, the leaves are nearly always parallel-veined, and the flowers have their parts in threes or a multiple of three, very rarely in twos or fours, but never in fives. In germination the original radicle issues from a sheath, and, in growing upward, each successive shoot of the stem issues from a former sheath. Palms, bananas, lilies, grasses, and sedges belong to this division.

ENDYMION (ĕn-dĭm'ĭ-ŭn), a mythical youth of Greece whom Zeus had endowed with eternal youth, combining with it the faculty of sleeping as long as he wished and whenever he desired. When Selene saw him asleep on Mount Latmos, his cold heart warmed by the beauty of the youth, and that being came from heaven every night to watch over and protect him. "Endymion," the beautiful poem of Keats, is based on this interesting legend.

ENEMY, in military, the term applied to either of two nations which are at war with each other. The state of enmity begins with a declaration of war, which may be either documentary or by actually taking up arms. Both parties in an armed conflict are called *combatants,* while all others that are interested but exempt from the operations of hostilities are known as *noncombatants.* During a state of war, when two or more nations are enemies to each other, all commercial relations are suspended. In some cases a state may permit its own citizens to trade with the enemy, but as a rule contracts made with an enemy cannot be enforced in the courts of law.

ENERGY (ĕn'ĕr-jў), the capacity to do work. Work is done at the expense of energy. All natural phenomena are caused by energy acting on matter. Whenever it is expended to produce a phenomenon, such energy must be drawn or transferred from some stock of existing energy. For example, when the spring of a watch is run down, and has thus expended the energy it possessed, it requires a new store of energy to be imparted to it. If a book falls from the table to the floor, it requires that energy be imparted to it in order to raise it from the floor to the table. When the book reaches the table, it has acquired energy sufficient to enable it to do work exactly equal to the amount expended on it in raising it that distance. This energy of motion is called *kinetic energy.* So long as the book rests on the table the distance times the weight of the book is stored in the book, and the energy so stored is called *potential energy.*

Experiments in great number have proved that there is never any destruction of energy. It may be transferred from one body to another, or differently distributed among bodies at different times, but the sum total in all the bodies is not lost. Matter and energy never change. In order to effect transmission, when there is no solid or fluid matter to act as a conductor, it must either leap through empty space, or be carried by something in space which we cannot see or otherwise detect. Hence, physicists assume the existence of a medium called *ether.* The energy which resides in ether waves is called *radiant energy.* The form of energy is known by diversified terms, dependent upon the nature of its work. It is designated as light, when it affects the eye; heat, when it raises the temperature; actinic, when it produces chemical changes; and electric, when it gives rise to conditions of electrification.

Since the sum total of energy in the universe,

like the sum total of matter, must constantly remain the same, it gives rise to the general law known as the *conservation of energy*. According to this law no form of energy can be produced except by the expenditure of some other form, nor can it be annihilated except by being reproduced in some other form. The general theory known as the *dissipation of energy* is based upon the tendency of all energy to be converted into heat, and in the form of heat it radiates into space and apparently is lost forever. According to this view, the sun will eventually become a cool and dark body like the earth, since its heat is constantly radiating off and is not returned to it.

ENFIELD (ĕn'fēld), a town of Middlesex County, England, nine miles north of London. It is celebrated on account of the manufacture of rifles and small arms for the government. The noteworthy features include the town hall, the public library, and the remains of a royal palace of Edward III. Enfield has a celebrated school at which Keats studied. It was the home of Charles Lamb. Population, 1921, 56,344.

ENFIELD, a town of Hartford County, Connecticut, on the Connecticut River, about ten miles south of Springfield, Mass. It is on the New York, New Haven and Hartford Railroad. Within the town is a community of Shakers known as Shaker Station. It has a public library and several fine schools. Among the enterprises is the famous Thompsonville carpet factory, in which about 350 looms are employed, having a capacity of 6,000,000 yards annually. It is the seat of the Hazardville powder mills, one of the largest institutions of the kind in the world. Other factories produce carpets, plows, sewing machines, timber products, and implements. Population, 1920, 11,708.

ENGEL (ĕng'el), **Ernst,** statistician, born in Dresden, Germany, March 26, 1821; died in 1896. He took a course of instruction at the school of mines in Freiburg, traveled extensively in European countries, and received an appointment, in 1848, as sceretary of the commission for investigating industrial questions. The following year he was made its president. He was connected with the bureau of statistics in 1850-58 and became its director in 1860. Among his works are "Prussia and Its Inhabitants," "The Age of Steam," and "Industrial Statistics of Germany, Europe, and North America."

ENGELMANN, George, botanist, born in Frankfort-on-Main, Germany, Feb. 2, 1809; died in Saint Louis, Mo., Feb. 4, 1884. He studied medicine and the natural sciences at Heidelberg and Berlin. Subsequently he was connected for some time with the University of Berlin, but came to the United States, settling in Saint Louis as a physician. In 1836 he founded a German newspaper, contributed to the "Proceedings of the American Academy," and secured an appointment under the government to prepare botanical reports in relation to North American plants. The most valuable portion of his work relates to the investigation of pines, cacti, and spurges. It is given in reports, including about 100, which have been published as the "Botanical Works of George Engelmann." His library and herbarium were bequeathed to the Missouri Botanical Gardens.

ENGINE (ĕn'jĭn), a machine of complicated parts for utilizing some force in nature to perform work. See **Steam Engine.**

ENGINEERING (ĕn-jĭ-nēr'ĭng), the art of making, building, or using engines and machines, or of designing and constructing public works, requiring special knowledge of materials, machinery, and the laws of mechanics. The range of knowledge required for the different departments is quite diversified, and each of these does not admit of strict definition as now divided. The six principal divisions of this branch of learning consist of military, marine, mechanical, civil, electrical, and mining. *Military engineering* includes the planning, constructing, and maintenance of fortifications and gunnery, artillery, and telegraphy as applied in warfare. *Marine* and *naval* engineering are concerned with works partly of a military and partly of a naval character, such as the planning and construction of vessels of war, engines, and torpedoes. *Mechanical engineering* requires efficiency in the invention, contrivance, and adjustment of machinery. It is necessary that the mechanical engineer be acquainted with the quality and strength of the materials used, the power of steam, and the parts of engines. In addition it is essential that he should understand the construction of various kinds of mills, including those propelled by steam, water, and wind.

The work of a *civil engineer* covers the most diversified field of study and was not developed in England until about the middle of the 18th century. The engineers employed in that country prior to that time were generally secured from Holland. Civil engineers have to do with the construction of railroads, canals, aqueducts, harbors, highways, bridges, and drainage works. *Electrical engineering* as an art sprang into recognition in recent years, owing to the larger and more diversified uses of electricity in machinery and the arts. The work of an electrical engineer has to do with the construction, fitting, and care of electrical machinery and the building of electrical car lines, telephones, and telegraph and oceanic cables. *Mining engineering* is concerned with the construction and operation of copper, iron, coal, and other mines. The general tendency is to specialize more closely from time to time the various departments of engineering.

Many important associations of engineers have been organized and are maintained in the United States. The most important among them are the American Institute of Mining Engineers,

American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers, and Western Society of Engineers. All of these have meetings at specified times to discuss important questions in relation to their interests, prepare published reports, and support libraries and periodicals for the general dissemination of knowledge and skill in their respective fields.

ENGLAND (ĭn'glănd), a country of Great Britain, the most important member of the United Kingdom of Great Britain and Ireland. It occupies all of the southern portion of the island of Great Britain, except the region in the west, which is included in Wales. It is separated from Scotland by the Solway Firth, the Cheviot Hills, and the Tweed River. The outline is in the form of a triangle, with the southern base 315 miles long, and the greatest distance north and south about 360 miles. Its coast line is greatly lengthened by numerous windings and indentations, the most important of which are the Bristol Channel, the estuary of the Severn, Morecambe Bay, Solway Firth, the Wash, the mouth of the Thames, Lyme Bay, and Plymouth Sound. It is separated from Europe by the North Sea, the Strait of Dover, and the English Channel, and Saint George's Channel and the Irish Sea separate Wales and England from Ireland. The area, according to official determinations, is 50,930 square miles.

Description. The surface in the eastern and southern parts is low and gently undulating, and is nicely diversified by slightly rounded elevations and broad, fertile valleys. Ranges of mountains and hills characterize the northern and northwestern part, some of which extend into Wales and form a continuation of the highlands of Scotland. The highest elevations include the Cornish Heights, the Cumbrian Mountains, and the Cheviot Hills; the last mentioned trend from Solway Firth parallel to the boundary line of Scotland. Scafell, one of the highest summits of England, is in the northern part and has an elevation of 3,210 feet. The Cumbrian Mountains, a region famed as the Lake District, is in the northwestern part of England and has peaks that rise about 3,000 feet above the sea. Toward the south, extending through Wales, are the Welch or Cambrian Mountains, and in the high peninsula of Devon and Cornwall are the lower simmits of the Devon Range. As a whole the surface of England is more productive and better adapted to agriculture than any other part of the British Isles.

Numerous small streams drain the surface, the larger number of which flow into the North Sea, hence the general slope is toward the east. Among the rivers which flow into the North Sea are the Thames, Huber, and Tyne, all of which are important for navigation. The Severn, Mersey, and Wye flow into waters tributary to the Atlantic, and are rendered useful for navigation by various improvements and canals. Other streams include the Trent, Wear, Avon, Tees, Dee, and Eden. However, the Severn is the most important in commerce since it has tides of extraordinary height, flows through productive coal fields, and is the longest of the streams. The Mersey has its source in the Pennine Mountains, and flows through a great manufacturing district. All of the streams and the coastal waters are rich in fish, including the cod, herring, mackerel, and haddock. Hull, Grimsby, and Yarmouth are centers of the fishing industry, but London takes rank as the most extensive fish market in the world, having its center at Billingsgate. The annual production of fish is valued at $32,500,000.

Mining. Coal is the most important mineral. It is produced in large quantities in Yorkshire, Lancashire, Derbyshire, and Nottinghamshire. Durham and York are among the centers of the coal mining region. Iron takes second rank in the mineral output and in its production England is exceeded only by the United States and Germany. Yorkshire and Derbyshire produce the greater portion of iron ore and tin is obtained chiefly in Devon and Cornwall. Lead and zinc are mined in Northumberland and small quantities of copper, gypsum, and salt are obtained in different sections. Building stone of all kinds is abundant, including limestone, granite, and sandstone.

Agriculture. The land is owned by a small per cent. of the population. Fully eighty-five per cent. of the surface which is under cultivation is rented in small tracts. Much care is exercised in tilling the soil and maintaining fertility. Estimated upon an acreage basis, more is paid for rent, labor, machinery, and fertilizers than in Canada or the United States. A large number of agricultural laborers have been displaced by the adoption of labor-saving machinery, especially in the sections where cereals are the principal crops. Indian corn is not grown, hence wheat, rye, barley, and oats are the chief cereals. Beans and peas receive much attention and considerable profit is obtained from fruit farming and gardening. Most of the farming is a mixture of crop growing and raising of live stock. England is noted for the Durham, Devon, Hereford, and Sussex breeds of cattle and the Cotswold, Southdown, and Leicestershire sheep. The Berkshire breed of hogs, which are grown extensively, have been naturalized in nearly all countries. Dairy farming receives marked attention. A superior class of horses is raised.

Manufactures. Manufacturing is the principal industry. In the output of manufactures England is exceeded only by the United States. Fully five times as many persons are engaged in this enterprise as upon the farms. This condition is brought about from the natural advantage of having an abundance of coal and iron, and the additional fact that England has

a large merchant marine to encourage foreign trade in the output of the manufacturing establishments. The textile industry is of first importance and the output consists largely of cotton and woolen goods. Manchester is the greatest center of cotton manufacture in the world, while Leeds has the largest woolen mills. Sheffield and Birmingham are centers of the iron and steel industry. Linens are made in large quantities at Leeds and Barnsley and silk manufacturing is carried on in Coventry and Macclesfield. Other manufactures include pottery, earthenware, chemicals, machinery, pins and needles, steel pens, chinaware, cutlery, and firearms. England has some of the largest shipyards in the world.

TRANSPORTATION. A fine system of canals was constructed before railroads were built and these are maintained in a high degree of proficiency. Almost every part of the country can be reached by the navigable waterways, which consist of the coastal waters, estuaries, and streams, and a system of canals that penetrates the trade centers. However, the bulk of the transportation is by railways, which have lines in England and Wales that aggregate 18,500 miles. Many of the canals are controlled by the railways and most of them have trunk lines into London. Much of the local traffic is carried by electric railways, which penetrate from the cities into nearly all sections of the country.

COMMERCE. See **Great Britain.**

CITIES. London, situated on the Thames, is the capital of the United Kingdom and of Great Britain and is the largest city in the world. Fourteen cities, including London, have a population of more than 200,000. These include, in the order of size, Liverpool, Manchester, Birmingham, Leeds, Sheffield, Bristol, Bradford, West Ham, Kingston-upon-Hull, Nottingham, Salford, Newcastle-upon-Tyne, and Leicester. Eighteen other cities have a population of more than 100,000, including Portsmouth, Bolton, Sunderland, Oldham, Croydon, Blackburn, Brighton, Willesden, Rhondda, Preston, Norwich, Birkenhead, Gateshead, Plymouth, Derby, Halifax, Southampton, and Tottenham. About seventy-eight per cent. of the people of England and Wales live in towns and cities.

EDUCATION AND INHABITANTS. England is divided into forty counties, each of which has the right of local self-government similar to that of the counties in Canada and the United States. Educational facilities are provided under a system of local taxation and grants by the state. A nominal compulsory school attendance law is well enforced. Much of the instruction is in private and denominational schools. A board of education has control of elementary education under a law which went into effect in 1900, by which the efficiency of instruction has been greatly increased. Oxford and Cambridge were the only great centers of higher learning at the beginning of the 19th century, but within that century four others were organized. These include Victoria University and the universities of London, Durham, and Birmingham. The inhabitants number about 610 to the square mile. Emigration and immigration have been about equal the last decade. Immigration is chiefly from other parts of Great Britain, Russia, Germany, and Belgium. Population, including Wales, 36,075,269. See **Great Britain.**

GOVERNMENT. See **Great Britain.**

LANGUAGE. The English language spoken in modern times is entirely Germanic in its general character and grammatical construction, though it resembles more nearly the Low German than the higher class in general use. There are three periods in its history, including the Old English, Middle English, and Modern English. The first of these extends from the German Conquest of England in about 450 to the Norman Conquest in 1066; the second to about 1400; and the last embraces all the period from the latter date. Old English or Anglo-Saxon included several dialects, all of which were highly inflected. Two languages were spoken from the Norman Conquest until about the middle of the 13th century, but these became greatly mixed, and, after a time, the French merged with the Anglo-Saxon, forming the Middle English, the language of Chaucer, Langland, and Wycliffe. Modern English differs so materially from the older forms that few words of the latter resemble the English of the present time. Discoveries, inventions, diversifications of industries, and advancement in science and sublety of thought have all modified and enlarged the language, and, for that matter, all others. It is estimated that the English language is spoken by about 115,000,000 people, though it is understood by fully 120,000,000.

LITERATURE. English literature is naturally divided into three periods—from its beginning to the Norman Conquest in 1066, from the Norman Conquest to the Reformation under Henry VIII. in 1527-47, and from the Reformation to the present time. The literature of the period antecedent to the conquest may be divided into Celtic, Latin, and Anglo-Saxon, and is of a form that cannot be read except by students making its study a specialty. The most eminent Celtic writers include Llywarch Hen and Merlin or Merddhin, and the Latin writers embrace Ethelwerd and Bede. The Norman period extends from the Conquest in 1066 to the commencement of English literature in 1255. Prior to the Conquest a form of Anglo-Saxon literature had developed. It was represented chiefly in the *Anglo-Saxon Chronicle,* which continued to be published until 1154, when the native language went practically out of use. At that time Latin was generally used in history, law, and philosophy, while French was employed in poetry and the literature for general reading.

After the loss of Normandy, in 1204, the English-speaking people gradually attained to a majority, and we find English employed by Roger Bacon, Geoffrey of Monmouth, and Geoffrey Chaucer. The last mentioned is regarded the first great poet of England, and, though a student of French romance and chivalry, he wrote verse in the English. He translated "The Romance of the Rose" into English, and in later years made a study of Italian literature, thus giving the English the benefits of translations from Dante, Boccaccio, and Petrarch. Among the most famous writings of Chaucer are "The Assembly of Fowls," "The House of Fame," and "Canterbury Tales." Though city-bred, Chaucer was a lover of the fields and flowers and showed a marked sensitiveness to the charm and beauty of the world. His "Canterbury Tales" is the most noted of his works. It is written in a poetic form and relates the plan of a company of thirty who journeyed from London to Canterbury, where they designed to visit the shrine of Saint Thomas à Becket. The poem relates the different stories told by each member of the company. Among the contemporary writers of Chaucer are the poets, John Gower (1325-1408), Robert Langland (1332-1406), and the prose writer, John Wycliffe (1324-1384). The writings of this period took on the form of the English as written at the present time.

The writers of England between the time of Chaucer and the end of the 16th century were largely imitators of that poet, including James I. of Scotland, John Skelton (1460-1529), and Sir Thomas More (1478-1535). It may be said that this period was generally barren, but with the invention of printing an appetite for literature began to awaken. This was due largely to the fact that the crusades came in contact with Greek scholarship in Constantinople and Southern Europe, where a taste for Greek and Roman literature was still alive. When the Turks drove the Greek scholars from Constantinople in 1453, they spread rapidly toward the west and found many young persons eager to learn the classics and philosophy of Greek and Roman masters. There was not only a tendency to journey to Italy for the purpose of studying, but scholars were induced to come to Western Europe and gradually found their way to England. It was the height of ambition to be able to read Homer and Plato, and to discourse on the writings of Demosthenes and Cicero.

The discovery of America induced a greater interest in geography, opened new avenues of commerce and social activity, and rapidly prepared for a transition from the Middle Ages to the dawn of learning. While Erasmus, the Dutch scholar and philosopher, was teaching Greek at Oxford, he aroused an interest in the New Testament, and published "The Christian Soldiers' Dagger." William Tyndale translated the New Testament into English, which he published in Germany in 1525, and circulated it extensively in England. In the meantime the Reformation in England came on in the reign of Henry VIII., who separated England from Rome, thus paving the way for the enthusiasm always attending a great epoch prominently affecting a large number of people. Sir Thomas More, the author of "Utopia," was beheaded, and many other writers suffered a similar fate.

Among the prominent literary men immediately after the Reformation are Sir Thomas Wyatt, the first artistic poet, and Henry Howard Surrey, a writer of sonnets and blank verse. These and other writers gave an impetus to literature by making songs and sonnets national, and prepared the way for the Elizabethan age of literature. This age is famous because of the large number of men who came forward with writings of merit, such as Edmund Spenser, William Shakespeare, Ben Jonson, Roger Ascham, Francis Bacon, and Lyle the Euphuist. Other writers of this period include Peele, Marlowe, Greene, Herbert of Cherbury, Middleton, Marston, Raleigh, and North. The writings of Shakespeare, which appeared between 1585 and 1616, are the most prominent of the period and in many respects are the finest in English literature. They possess a wealth of imagination rarely equaled, and embody passages of the gravest wisdom, the purest motives, and the tenderest feeling.

Ben Jonson holds a high rank as a song writer and produced a number of excellent comedies and other plays. Philip Massinger (1583-1640) ranks among the dramatists of this period; Abraham Cowley (1618-1667), among the lyric poets; Thomas Hobbes (1588-1679), among the historians; and John Milton, among the poetical and prose writers. Milton's "Paradise Lost" is a masterpiece of English literature. Other writings of Milton include "Paradise Regained," "Il Penseroso," "Hymn on the Nativity," and "L'Allegro." Other religious writers of the same period include James Usher (1581-1656), Jeremy Taylor (1613-1667), John Biddle (1615-1662), and Richard Baxter (1615-1691). John Bunyan, author of "Pilgrim's Progress," marks an epoch in English literature. Few works have been so widely translated and so extensively read as his masterpiece, the "Pilgrim's Progress."

John Dryden wrote many popular plays after the Restoration. He is the author of "Hind and Panther," a religious discussion, and "Absalom and Achitophel," a famous satire. The death of Dryden in 1700 marks the beginning of the Augustian age in English literature and its greatest poet is Alexander Pope. This age witnessed the advent of many scientific and philosophical writers, among them Sir Isaac Newton, John Ray, John Locke, Richard Steele, Joseph Addison, Jonathan Swift, James Thompson, and Thomas Gray. James Thomp-

son is best remembered by his "Seasons," Thomas Gray by his "Elegy Written in a Country Churchyard," and Daniel De Foe by his "Robinson Crusoe." Samuel Richardson published "Pamela," one of the first modern novels, and Henry Fielding is favorably known by his "Joseph Andrews," "Tom Jones," and other novels.

Samuel Johnson stands as the literary representative of the second half of the 18th century. His most famous works include "Lives of the Poets" and "Vanity of Human Wishes." The name of Oliver Goldsmith is inseparably connected with that of Johnson. He is the writer of "Vicar of Wakefield," "The Deserted Village," and the comedy "She Stoops to Conquer." William Cowper is an eminent poet of the latter part of the 17th century and is noted for his introduction of profound religious sentiment. Richard B. Sheridan is the author of "School for Scandal" and a number of other popular writings. David Hume, Adam Smith, Edmund Burke, and Edward Gibbon are among the most eminent historians and political writers of the latter part of the 18th century.

The 19th century is the greatest in the history of English literature, both in the character of the productions and in the number of writers. The early writers of this period include Samuel T. Coleridge, whose "Ancient Mariner" represents the finest type of ballads; William Wordsworth, author of "Recollections of Early Childhood," and Sir Walter Scott, writer of "Ivanhoe," "Rob Roy," "Kenilworth," "Lay of the Last Minstrel," and "Lady of the Lake." Other poets of the 19th century include Lord Byron, Percy Shelley, John Keats, George Crabbe, Leigh Hunt, Thomas Moore, Alexander Smith, Elizabeth Browning, Robert Browning, Lord Lytton, Robert Buchanan, Alfred Tennyson, William Morris, Matthew Arnold, and Charles Mackay. The novelists embrace Jane Austen, Lord Lytton, Benjamin Disraeli, Charles Dickens, Charlotte Brontë, Charles Reade, Charles Kingsley, George Eliot, William Thackeray, George Meredith, R. D. Blackmore, George MacDonald, and Thomas Hardy. Among the philosophical writers are John Stuart Mill, Alexander Bane, Sir W. Hamilton, Charles Darwin, Herbert Spencer, Max Müller, Thomas H. Huxley, John Tyndall, and T. H. Greene. The historical and biographical writers include Thomas B. Macaulay, Thomas Carlyle, John R. Green, Lesley Stephen, John Morley, Cornwall Lewis, James A. Froude, Alexander W. Kinglake, William E. Lecky, and Dean Stanley. Among the prominent theological writers are Isaac Taylor, Julius Hare, Stopford Brooke, Henry P. Liddon, Augustus Hare, John H. Newman, Richard Whately, and John Maurice. Other writers of note include John Ruskin, Harriet Martineau, W. E. Gladstone, Sir Arthur Helps, Matthew Arnold, Thomas De Quincey, George Grote, Michael Faraday, Edward A. Freeman, and Thomas Henry Hall Caine.

The beginning of the 20th century marks a period of great activity in the field of literature. In 1907, which is a representative year, there were issued a total of 7,701 new books in England, besides 2,213 new editions of books formerly published. The greatest number were in the line of fiction, a total of 1,862 new books and 920 new editions of old books. Those coming next in numerical order are books on the arts and sciences, theology, history, politics, education, and poetry. The period is noticeable for its greater exchange of books with Canada and the United States, especially in the lines of fiction, theology, and politics. Among the more widely read recent authors may be named Winston Churchill, H. Rider Haggard, Alfred Austin, Frances Hodgson Burnett, Edith Wharton, Rudyard Kipling, James Bryce, George Otto Trevelyan, Arthur James Balfour, Andrew Lang, and John Morley.

History. England was invaded by the military forces of Caesar in 55 B. C. and later became a Roman possession. Its history proper begins with the withdrawal of the Roman forces in the early part of the 5th century A. D., when the Germanic people invaded portions of what was known as Albion or Britain. These Germanic people first moved west from Germany into the lands now called Denmark and Schleswig. Later many removed to England, being attracted by opportunities of development and numerous settlements that had previously been made by the Gauls, Germans, Iberians, Dacians, Italians, Phrygians, and others that located in the country during the time of the Roman occupation. Those conquering the country were made up largely of Jutes, Angles, and Saxons, the term Anglo-Saxon originating from the latter two, and the country itself deriving its name from the Angles or Inglisc.

The German ideas and forms of local government began to be introduced about the middle of the 5th century, and from them the language and civil institutions largely originated. From this mixture of races, which was influenced, no doubt, by non-Aryan races that preceded them, among them the Euskarians and Celts, sprang the English, a self-reliant, industrious, ambitious, and daring people, who built up a language and institutions which have in a large measure influenced the trend of modern arts and civilization.

The early history and events that led to the final building of an independent kingdom were complicated by many civil and religious struggles, which extended themselves over a period including many centuries. The Jutes formed settlements in the Isle of Wight, Kent, and adjacent regions, while the Saxons occupied tracts in the south, and the Angles in the north. The struggle for supremacy which resulted from conflicting claims cover a period

of 150 years. It finally terminated to the advantage of the Teutonic tribes, who ultimately occupied the entire southern portion of Britain, except only Wales, West Wales, and Strathclyde. The territorial divisions were small, though seven of the most important formed an alliance of friendship known in history as the *Heptarchy*. This protracted struggle in the course of time resulted in annexing the smaller divisions to the more powerful neighbors. Egbert succeeded in securing sovereignty over the seven kingdoms in 827, and made himself ruler of a large part of the country, to which the name England was first applied. Prior to the Teutonic conquest Britain was largely isolated from continental Europe, but soon after the learning and culture of older civilization was introduced, a closer intimacy was established, and a written literature began to form. Though the conquerors were strangers to Christianity, they were converted district by district after a severe contest, which reached its height in the 7th century. Soon after the Danes began to make incursions. About fifty years after the formation of the United Kingdom they became masters of the whole of England, though their reign was only momentary.

Alfred the Great ascended the throne in 871 and succeeded in defeating the Danes at Ethandune in 878. The nine succeeding monarchs were more or less in conflict with Danish incursions, the latter of whom, Edmund II., was compelled to surrender a portion of his kingdom to Canute, and, when the former was assassinated in 1017, the sovereignty of the entire country fell into the hands of the Danes. The name *Great* was attached to Canute on account of his personal qualities and the extent of his possessions, which included, besides England, Denmark and Norway. He was followed by two Danish kings who managed the government with moderation, though their reign was disturbed by Norman incursions and Saxon revolts. Two Saxon kings followed the Danish, but in 1066 the country was conquered by William of Normandy. This military achievement, known in history as the *Norman Conquest*, caused the country to be governed by Norman kings 69 years. After the death of Henry I., Stephen, son of the Count of Blois, raised an army in Normandy with which he proceeded to England and claimed the kingdom. Civil war was carried on for a series of years, but finally terminated in a peace, in which Stephen was recognized as sovereign for life, but Henry, son of Matilda, daughter of Henry I., was to succeed him on the throne. As Stephen died in 1154, Henry II. became his successor, and the Plantagenet line of succession ruled England for 245 years.

During the reign of the Plantagenet line the country was more or less disturbed by conflicting claims of the people against the feudal system of land ownership established after the Norman Conquest. Wars with Wales and Scotland likewise tended to distress the government, but they operated to unite the people of England as against foreign invasion, although they were divided by the conflicting pretensions of the Lancasters and Yorkites. The claims of the people to their ancient rights and liberties were recognized in the *Magna Charta*, called the Great Charter, on June 15, 1215, and, under the leadership of Simon de Montfort, Henry III. was seized and required to pledge the organization of Parliament, which gave the people the right of representation and led to the permanent establishment of the House of Commons. Richard II. was compelled to surrender to 60,000 malcontents. He was succeeded in 1399 by Henry IV., the first representative of the house of Lancaster, which governed England for 62 years. The prosecution of the Lollards took place in the reign of Henry IV. He was succeeded by Henry V., in 1413, who gained marked successes over the French and was to succeed to the throne of France. However, the advantages he gained were lost by his son, Henry VI., largely through the achievements of Joan of Arc. His reign was succeeded by the York dynasty after a long line of struggles for supremacy.

Henry Tudor gained the Battle of Bosworth in 1485, in which Richard III. was slain, and the throne was ascended by Henry VII. During the reign of his successor, Henry VIII., England was disturbed by the Reformation. Events formed quickly by which Elizabeth ascended the throne and became the nominal head of the Protestant faith. Her reign was characterized by remarkable rivalry in architecture, literature, and commercial competition for colonization in opposition to Spain. She was succeeded by James VI. of Scotland, son of Mary, Queen of Scots, who assumed the title of James I. of England. This placed the Stuarts upon the throne after a long contention, but their sovereignty was weakened by constant disputes with the Parliament and the rise of the republican forces, stimulated largely by Oliver Cromwell. The people finally wrung from the king the right of petition, by which the power to levy taxes became vested in the House of Commons, and the king was abridged in his authority to govern in many matters of vast interest. Cromwell succeeded in establishing the Commonwealth in 1649, with himself as Lord Protector, though it survived him but a short time, terminating abruptly under the feeble protectorate of his son, Richard, and Charles II. was called to the throne by the Restoration of 1660.

The old dissensions between the king and Parliament soon broke out anew and William of Orange, supported by the Whig party, drove James II., successor of Charles II., from the country and became the first parliamentary king. When Queen Anne ascended the throne, she found the grand alliance with Holland and

Germany of much value. Her government was further strengthened by the success of her army at Blenheim in 1704 and at Ramilies in 1706, under Marlborough. The history of England became merged into that of Great Britain in 1807, by virtue of the act of union passed in that year uniting England and Scotland. In 1714 the Hanover dynasty succeeded to the throne and the last attempt of the Stuarts was thwarted in 1715. For more recent history, see Great Britain, War.

Below is a list of English sovereigns:

Dynasty and Title.	Began.	Years.
Anglo-Saxon Line.		
Alfred, King of Wessex	871	30
Edward I., King of Wessex	901	24
Athelstan, King of England	925	15
Edmund I.	940	6
Edred	946	9
Edwy	955	4
Edgar	959	16
Edward II.	975	3
Ethelred	978	38
Edmund II.	1016	1
Danish Line.		
Canute	1017	19
Harold I.	1036	3
Hardicanute	1039	2
Saxon Line.		
Edward III.	1041	25
Harold II.	1066	..
Norman Line.		
William I.	1066	21
William II.	1087	13
Henry I.	1100	35
House of Blois.		
Stephen	1135	19
Plantagenet Line.		
Henry II.	1154	35
Richard I.	1189	10
John	1199	17
Henry III.	1216	56
Edward I.	1272	35
Edward II.	1307	20
Edward III.	1327	50
Richard II.	1377	22
House of Lancaster.		
Henry IV.	1399	14
Henry V.	1413	9
Henry VI.	1422	39
House of York.		
Edward IV.	1461	22
Edward V.	1483	..
Richard III.	1483	2
House of Tudor.		
Henry VII.	1485	24
Henry VIII.	1509	38
Edward VI.	1547	6
Mary	1553	5
Elizabeth	1558	45
Stuart Line.		
James I.	1603	22
Charles I.	1625	24
Commonwealth.		
Oliver Cromwell	1649	10
Richard Cromwell	1658	..
Stuart Line.		
Charles II.	1660	25
James II.	1685	3
House of Orange.		
William and Mary	1688	14
Stuart Line.		
Anne	1702	12
Hanover (Windsor) Line.		
George I.	1714	13
George II.	1727	33
George III.	1760	60
George IV.	1820	10
William IV.	1830	7
Victoria	1837	64
Edward VII.	1901	9
George V.	1910	....

ENGLAND, Church of, the dominant religious body of England and the established church of that country. It claims to be a true and apostolical church, teaching and maintaining the doctrines of the apostles. The law recognizes it as the national church and protects it in the endowments; that is, the gifts of land and tithes made to it in ancient times. As at present organized, it dates from the time of Henry VIII., who abolished papal authority in England and established the independence of the Church of England. He became the supreme head of the church, dissolved the monasteries, and convoked an assemblage of clergymen to pass upon ten articles of faith drawn up at his suggestion. This convocation declared against the invocation of saints, the worship of images, and the belief in purgatory, and expressed the view that the whole Christian faith is to be found in the Bible. This was soon followed by the publication of the Bible in English, which greatly tended to spread the reformed doctrine, and prayers and services began to be in English. During the short reign of Edward VI., son of Henry VIII., the reforming element had complete sway, and came to look with favor upon the teachings of Luther and Calvin, but a strong reaction occurred when Mary, who was a Catholic, ascended the throne. She exerted an unrelenting influence to reëstablish Catholicism, and many of the reformed clergy escaped to the continent, while those remaining in England were persecuted as heretics or compelled to retract.

Queen Elizabeth ascended the throne in 1558 and favored the Reformation, but contentions now arose with the Puritans, who had gained many adherents during the reign of Queen Mary. The Thirty-Nine Articles, originally 42 in number, but now 39, had been drawn up in 1551 under Cranmer and Ridley, and these were reviewed and revised. A convocation of the clergy accepted the amended articles and they were ratified by the queen, and Parliament legalized them in 1563 and later made it compulsory for the whole clergy to subscribe to them. Together with the homilies and prayer books, they constitute a complete exposition of the tenets held at present by the Church of England on all the main points of doctrine and discipline. The church has possession of the ancient religious edifices and the cemeteries attached to them. It is protected by law in the exercise of its right and its teaching is accepted by the state. It is one of the states of the realms and has an integral part in all legislation.

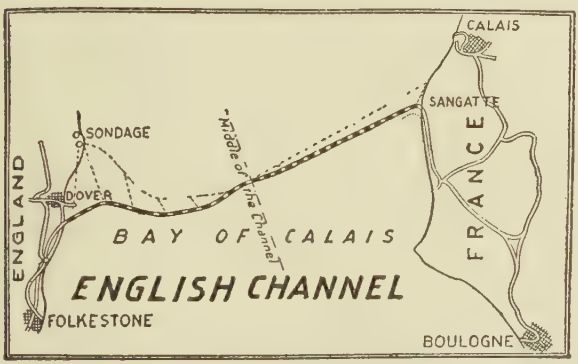
The government of the Church of England is under a system of jurisprudence made up of three elements; namely, the common law, the canon law, and the statute law. The first consists of customs and precedents; the second, of canons passed or accepted by the English synods; and the third, of acts of Parliament relating to the church. Two archbishops, those

of Canterbury and York, preside over the two provinces into which the country is divided, but the Archbishop of Canterbury is the primate of all England. The provinces are divided into dioceses, which are presided over by bishops, and those subject to them include the archdeacons, deans, canons, prebendaries, rectors, vicars, and curates. Missionary work is carried on in all parts of the civilized world. The Episcopal Church (q. v.) is a branch of the Church of England.

ENGLEWOOD (ĕn'g'l-wo͝od), a city of New Jersey, in Bergen County, fourteen miles north of New York City. It is situated near the Palisades of the Hudson River, on the Erie Railroad, at the edge of the Hackensack Valley. The chief buildings include the public library, a hospital, and the high school. Many New York business men reside in Englewood. It was incorporated as a village in 1860 and chartered as a city in 1896. Population, 1905, 7,922; in 1920, 11,617.

ENGLISH (ĭn'glĭsh), **William Hayden,** public man, born in Lexington, Ind., Aug. 27, 1822; died Feb. 7, 1896. He graduated from Hanover College, Indiana, and built up a successful law practice. In 1843 he was clerk in the lower house of the Indiana Legislature, and served as a Democrat in the United States House of Representatives in 1853-61. He was nominated for Vice President with Winfield S. Hancock in 1880, but was defeated in the election. In 1853-61 he was a regent of the Smithsonian Institution. He published "Life of George Rogers."

ENGLISH CHANNEL, an important body of water which connects the Atlantic Ocean with the North Sea and separates France from England. On its eastern end it is connected with the Strait of Dover, where it is twenty-one miles wide, and at the western end it has a width of about one hundred miles. A strong current running eastward passes through the channel, influenced largely by the Gulf Stream, and its waters are often disturbed by storms. The Isle of Wight and the Channel Islands are within the channel. Among the English ports are Brighton, Dover, Falmouth, Plymouth, and Southampton. The French ports include Boulogne, Calais, Cherbourg, Dieppe, and Havre. A plan to construct a railway tunnel from Dover, England, to Calais, France, was proposed as early as 1875. Several bills were before Parliament in 1908 and since, but no material progress has been made, aside from surveying the route from Dover to Sangatte. The estimated cost of the tunnel is $80,000,000. Gertrude Ederle, of New York, was the first woman to swim across the Channel, in 1926.



ROUTE OF PROPOSED TUNNEL FROM ENGLAND TO FRANCE.

ENGLISH LANGUAGE. See **England.**

ENGLISH LITERATURE. See **England.**

ENGRAVING (ĕn-grāv'ing), the art of cutting marks or figures on wood, stone, or metal. Engraving is very ancient, being mentioned in Exodus xxviii, 36. The oldest records were cut in stone, some by making depressions and others by cutting the stone away and leaving the characters in relief. In Egypt the hieroglyphics were cut in the granite monoliths and on the walls of tombs and chambers. Later the Greeks learned the art from the Egyptians and Phoenicians. The discovery of the practicability of taking impressions upon paper from an engraving was made by a Florentine artist named Maso Finiguerra, about 1440. In taking a cast in sulphur of some engraved church ornaments, a quantity of dust and charcoal, which had gathered in the lines of the engraving, came out upon the sulphur and gave suggestive effect.

Many kinds of engravings are employed in the arts, depending upon the purposes they are to serve. They include *line engravings* on metal plates, usually copper or steel; *etchings* on metal in which the lines are corroded by means of acid; *mezzotints,* in which there are no lines, but only shades produced by roughening the surface of the metal; and *woodcuts.* Wood engravings long preceded those made of metal.

The process of printing from engravings was common in China in the 10th century, but it remained a secret with them for many years. The Italians and Germans attained considerable skill in engraving as early as the 13th century, but the earliest known niello proof on paper was made in 1452. Within the three succeeding centuries the art became extremely productive under such artists as Albert Dürer (1471-1528) and Peter P. Rubens (1577-1640), and developed until imitations of all varieties of engravings were made in woodcuts, but the practiced eye sees at a glance that the result is nothing but a woodcut. Through lack of encouragement, change of fashion, and the adoption of other cheaper methods of production the woodcut and line engravings are going rapidly out of use. Besides, there are not sufficient induce-

ments for young men to pursue study in this particular process of engraving, for the reason that the newer and more rapid methods are supplanting it.

Copper is used extensively in making plates for certain kinds of engravings, especially those in which a soft metal is serviceable. The invention of steel engraving in the United States has brought that metal into use for the finer pictures, owing to its greater hardness, which enables it to overcome the wear of printing and makes it possible to take a larger number of impressions than can be gotten from a copperplate. Etchings are made by covering a prepared metallic surface with a thin coat or ground, which is not affected by acid. The design is traced with a pointed tool, which lays the metal bare wherever it touches. A wall of wax is raised around the design to hold the diluted acid, when poured on. For a copperplate this consists of five parts water and one part nitrous acid; for steel, pyroligneous acid one part, nitric acid one part, water six parts. The acid corrodes on the lines made through the ground. This is called biting in. When a sufficient depth is attained for lighter tints of the etching, the acid is removed and the surface is washed and allowed to dry. The parts of sufficient depth are now varnished and, when dry, another biting in deepens the lines not varnished, and, when deep enough for the second tint, it is removed again. This may be repeated several times, if necessary. The process of deepening the lines in this way is called *rebitting.* Etchings are sometimes finished by a graver and partake of the character of a line engraving. Glass may be engraved in a similar manner. Soft-ground engraving is another of the many ways of drawing the design. In mezzotint engraving the entire surface of the plate is roughened slightly, after which the drawing is traced, and then the portions intended to show high lights or middle lights are scraped or burnished, and the shadows are strengthened. Engravings so produced resemble photographs.

It is to be noted that the photomechanical processes of engraving have been improved materially since 1880. These include the *half-tone process* invented by Frederic E. Ives, an American, in 1881; the *line-relief process;* the *intaglio-engraving process;* and the *wax process.* The half-tone is used largely in the better class of magazines; the line-relief process, for cheap newspaper illustrations; the chalk-plate, for small newspaper cuts and generally by the government in making weather maps; and the wax process, for making railroad, geographical, state, county, and town maps.

ENID (ē′nĭd), county seat of Garfield County, Oklahoma, about 70 miles northwest of Oklahoma. It is on the Saint Louis and San Francisco, the Chicago, Rock Island and Pacific, and other railroads, and is surrounded by a fertile farming region. The chief buildings include the high school, the county courthouse, and several churches. It is important as a shipping center for grain and live stock. The manufactures include flour, brick, ice, clothing, confectionery, and machinery. It has grown very rapidly since 1893, when the Cherokee strip was opened for settlement. Population, 1900, 3,444; in 1920, 16,576.

ENNIUS (ĕn′nĭ-ŭs), **Quintus,** Roman poet, born at Rudiae, Italy, in 239 B. C.; died in 169 B. C. He is considered the father of Latin poetry and claimed descent from a mythical hero. Little is known of his early life. He appears to have been a soldier in the Roman army, enjoying the friendship of Cato the Elder, who invited him to Rome, where he gained the friendship of Scipio Africanus the Elder. He is the author of tragedies, comedies, and a number of poems, but only fragments of his writings are now extant. His poem on Roman history, entitled "Annales," is the chief foundation of his fame.

ENOCH (ē′nok), the son of Jared and father of Methusaleh, called "the seventh from Adam" to distinguish him from Enoch, the son of Cain, who was the third from Adam. In the Scripture it is stated that "he walked with God" and "pleased him," and it is thought that he was transported to Heaven, since we are told that "he was not, for God took him." Mention is made of him in Heb. xi., 5 and in Jude xiv., 15. The Book of Enoch is a prophetical work mentioned in many writings of the fathers. It is apochryphal and contains 108 chapters. Jude xiv. and xv. quotes from it. It is not certain when or by whom it was written, but it is generally assigned to the time of the Christian Era and was probably written in the Hebrew.

ENSILAGE (ĕn′sĭ-lā′), in agriculture, a process of preserving green forage crops for stock food. Dairy farmers have a method of storing green fodder in mass and covering it over in deep trenches cut in a dry soil, by which the natural condition is readily preserved, though the ordinary way of handling ensilage is by cutting the crop, usually corn, and placing it in an air-tight mow or silo for curing. The crop product is stored as near as practicable to the place of feeding in order to insure the greatest possible convenience. In corn culture for ensilage farmers aim to produce the largest possible quantity of both corn and forage. The crop is cut a brief period before being ripe enough for ordinary cutting. It is then taken to the mow and, after being cut in proper lengths, is carefully stored by placing successive layers and tramping them as firmly as possible. The ensilage may be stored to a height of 20 or 30 feet, and, after settling several days, the upper portion may be refilled. Another method which has been introduced recently is to cut the fodder by a machine, which at the same time elevates the finely cut product into

the top of the silo by a current of air. The silo should be air tight and so constructed that it can be emptied from the side. This class of forage crops is a very nutritious and wholesome food for cattle, sheep, and horses. Successive experiments have proved that more food can be secured per acre by the culture of crops and their preservation as ensilage than in any other way.

ENTOMOLOGY (ĕn-tŏ-mŏl'ŏ-jў), the science which treats of insects. Aristotle called attention to one of the essential characteristics by pointing out that the bodies of insects are cut or divided into segments, from which their name was derived. See **Insects.**

ENTOZOA (ĕn-tŏ-zō'à), the name given by Karl Asmund Rudolphi (1771-1832), a Swedish naturalist, to a class of animals living within the bodies of other animals. They are found in the intestines, liver, brain, muscles, and other tissues. According to a group of writers the entozoa are divided into three classes: coelelmintha, or hollow worms; sterelmintha, or solid worms, as the tapeworms; and accidental parasites. Some writers treat them as equally mature and immature; the latter, inclosed in cysts, being far the most dangerous when found in inclosed cavities, as the lung or liver. See **Parasites.**

ENVELOPES (ĕn'vĕl-ōps), in botany, the whorls of alternated leaves designed to protect the organs of fructification from injury. In very rare cases there are none, sometimes one, though generally two—the calyx and the corolla. The name also applies to paper coverings for letters or notes that came into extensive use with the growth of the postal system. They are now shaped, folded, and gummed by machinery. A single machine of the larger type has a capacity to turn out 50,000 envelopes per day.

ENVIRONMENT (ĕn-vī'rŭn-mẹnt), a term used to indicate the sum of external conditions that limit or direct the activities of an individual. It is frequently used in distinction of the term heredity, which is the tendency possessed by an individual to resemble the ancestral stock in general characteristics, while environment includes everything which is not identified with the individual self. The subject divides itself into two kinds, the physical and the social. The former includes all the outside influences with which one may come in contact, such as climate, food conditions, the physical features of a country, the absence or presence of enemies, etc. Social environments embrace principally the customs, habits, industries, religion, institutions, etc. Physical environments exercise a marked influence upon both animal and plant life, and social environments refer more particularly to the animal kingdom.

The word *environment,* in the field of education, expresses best the things which make for character by their silent influence. These mold lives from day to day by their silent impressions upon the individual. Children reared in clean and tidy homes, under the influence of moral and humane teaching, obtain a bent of desires and thoughts toward the orderly and noble. The home and the school share, perhaps, equally the responsibility of early impressions, hence the need of providing such environments as will tend toward and uplift the moral and physical life of the young. Such influences, together with the part exercised through outside factors, are potent in determining the character of an individual as well as of the community in which he lives. It may be said that under primitive conditions of civilization social environments exercise a minor influence, but with the advancement of society and the enlargement of communities comes the need of exercising great care in selecting or shaping the environments with which the young may come in contact.

EOCENE (ē'ŏ-sēn), in geology, the first great division of the Tertiary period. It was the dawn of the present order of shells and mollusks, a few birds, reptiles, and all the invertebrate animals still living. Among the plants both endogens and dicotyledons were numerous. Man had not appeared upon the earth. The Eocene strata consist of marl, limestones, clays, and sandstones. In most cases the strata were deposited in salt or brackish waters.

EOZOIC (ē-ŏ-zō'ĭk), the name given to rocks of the Laurentian age, in which, so far as at present known, the earliest traces of life are found.

EPACT (ē'păkt), a number introduced into the Gregorian calendar, employed to express in days the age of the moon on Jan. 1, and thus to determine its age on March 21. The Council of Nice appointed Easter Sunday to be the first Sunday after the first full moon following the vernal equinox, and this Sunday is now found by a formula. When the epact is known, it is possible to calculate the dates of all the following lunar phases throughout the year. To find the epact it is necessary to know the golden number, which is ascertained by adding 1 to the date of the year and dividing the sum by 19. The remainder is the golden number, except when the remainder is 0, when the golden number is 19. Having found the golden number, the epact of any year between 1900 and 2199 may be found by the following table. Suppose the golden number to be 15, it will be seen that the epact is 3:

Golden Number	Epact	Golden Number	Epact
1	29	11	19
2	10	12	30
3	21	13	11
4	2	14	22
5	13	15	3
6	24	16	14
7	5	17	25
8	16	18	6
9	27	19	17
10	8		

EPAMINONDAS (ê-păm-ĭ-nŏn'dăs), noted Greek hero, born about 418 B. C.; slain in 362 B. C. He came from an ancient family and lived in retirement until he was forty years of age, but was finally inspired with enthusiasm by Lysis, a follower of Pythagoras. In 385 he saved the life of Pelopidas in battle, a man of much virtue. Later he enlisted in the ranks of the patriots and raised Thebes to the summit of power and prosperity. When sent to Sparta in 371, he displayed much firmness in negotiating terms of peace, though the treaty was not ratified and war was resumed. He was placed at the head of the Thebans and four times successfully invaded the Peloponnesus, and, when success had followed his last effort, he was mortally wounded by a javelin. The ancients extolled the justice and moral purity of Epaminondas as much as his military talent, and it is said of him that he never deviated from the truth, observing strict veracity even when jesting.

EPHESUS (ĕf'ê-sŭs), an ancient city of Asia Minor, situated in Lydia, near the mouth of the Cayster River. It was classed with the twelve Ionian cities founded by the Greeks, and was regarded sacred from an early period, though its importance dates from a time quite more recent than the Trojan War. The first of its great temples was founded about 650 B. C., completed after 120 years, and destroyed in 356 by Herostratus. It passed successively under the possession of the Lydians, Persians, Greeks, and Romans. In the time of Augustus it attained its greatest importance as a trade center, and was for three years the residence of Saint Paul, who afterward wrote his "Epistle to the Ephesians," while in prison at Rome, to the church at Ephesus. The second magnificent temple was destroyed by the Goths in 262 A. D., and they so plundered the city that it never again recovered its importance. The Third Ecumenical Council of the Christian church was held at Ephesus in 431, at which resolutions condemning Nestorius were agreed upon.

The famous temple of Diana, counted among the seven wonders of the world, was located a mile east of the city, and at the birth of Alexander the Great the Ephesians burned it to add luster to his name. Many contributions were given and heavy taxes levied for the purpose of rebuilding it with even greater splendor, the new structure being the greatest of Grecian temples and containing 130 columns. This remarkable structure was 225 feet wide and 423 feet long, and contained statues and pictures of the most noted Grecian masters. Nero robbed it of its treasures and the Goths burned it, and its destruction was finally accomplished by an edict issued in 381 against pagan worship by Theodosius I. After numerous excavations were made by Europeans, the site of the temple was discovered in 1869, and many interesting remains were secured. In 1899 the Austrian Institute at Ephesus excavated several valuable relics, among them statues, a great market place, and a remarkable theater. Aiasoluk, a small village, is near the site of the city.

EPHRAIM (ē'frā-ĭm), the second son of Joseph, the founder of the tribe of Ephraim. The Ephraimites occupied a fruitful district in the center of Palestine. Their possession included most of the province afterward called Samaria. Within it were many places of historical interest, especially those between the Jordan and the Mediterranean. The tribe of Ephraim for a long time was in possession of the ark and the tabernacle at Shiloh.

EPIC (ĕp'ĭk), a poem characterized by its narrative and descriptive style, especially one that celebrates in stately, formal verse the real or mythical achievements of heroes or great personages. Epic poetry is distinguished from lyric by giving prominence to the narration of action rather than the expression of emotion, and from drama in that the epic contains frequent allusions to the author as narrator. Among the great sacred epics of the world are Dante's "Divina Commedia" and Milton's "Paradise Lost." The heroic epics include Homer's "Iliad" and "Odyssey," Virgil's "Aeneid," Tasso's "Jerusalem Delivered," and Aristo's "Orlando Furioso." Among humorous epics are Pope's "Rape of the Lock," "Battle of the Mice," and "Reynard the Fox." Byron's "Childe Harold" is written in a narrative style, but abounds in sentiment, and is both epic and lyric. This is true of Burns's "Cotter's Saturday Night," Bryant's "Thanatopsis," and Longfellow's "Evangeline."

EPICTETUS (ep-ĭk-tē'tŭs), Greek Stoic philosopher, born in Hierapolis, in Phrygia, about 50 A. D.; died about 94 A. D. His early life was spent as a slave at Rome, where he became a nominal Stoic. After attaining his freedom, he studied philosophy, was driven into exile by Emperor Domitian, and settled in Nicopolis, in Epirus, near the scene of the Battle of Actium. His maxims were collected by his pupil Arrian and published in a work called "Encheiridion," meaning hand-book, and a number of "Commentaries." The works still extant show an earnestness and nobility of character rarely surpassed. Among his teachings may be enumerated the theory that education lies in learning to wish things to be as they really are, and in acquiring ability to distinguish our own from the possessions of others. In other words, the sole true cause of our acting lies in our opinions and judgments, under the direction of a will.

EPICUREANISM (ĕp-ĭ-kû-rē'ăn-ĭz'm). See **Epicurus.**

EPICURUS (ep-ĭ-kū'rŭs), famous Greek philosopher, born on the island of Samos in 342 B. C.; died in 270 B. C. He was the son of Neocles, who was a schoolmaster, and at the age of eighteen years went to Athens, where he

studied for a brief period under several masters, and later pursued the study of philosophy. He was influenced largely by the teachings of Anaxagoras and Democritus, and when 32 years of age opened a school of philosophy at Mitylene. Five years later he returned to Athens, where he founded a school of philosophy on a tract of land purchased by him and converted into a garden, from which his pupils were called "philosophers of the garden." Among his principal teachings may be enumerated the theory that happiness consists in living temperately, being kind to others, and feeling content with one's own condition, though he held pleasure to be the highest good. His school became a great center of learning, attracted vast numbers from Asia Minor and various portions of Greece, and was a prolific cause of stimulating thought and directing effort. His writings included a large number of volumes, according to some writers about 300, on "Natural Philosophy," "Justice," "Love," "Avoidance," "Atoms and the Vacuum," "Virtues," and numerous others.

Few of the writings of Epicurus are extant, though such fragments as "A treatise on Nature" and detached messages still exist, but his teachings are known from the speeches of Cicero, Diogenes, Laertius, and Lucretius. His doctrine, that pleasure is the highest good, led to the practice in life called *Epicurean.* It was understood by the Greeks, Romans, and later by the French societies to imply freedom in action and living, and one holding to this school is still called an *epicure.* Some writers think that his views in regard to pleasure have been largely overdrawn, or perverted to a more liberal application than he intended. It is certain that Epicurus was a man of deep research and that he added knowledge of material value. According to his views the cares of business arise from dependence on others, personal fear, and weakness. He taught that death, though the most terrible of evils, should not concern us, "since, when we are, death is not, and, when death is, we are not."

EPIDEMIC (ĕp-ĭ-dĕm′ĭk), a disease which attacks many persons at the same time, spreading suddenly, often extremely virulent and fatal at first, then gradually becoming spent and feeble, so that the earliest stages are usually the worst. The plague, cholera, influenza, and la grippe are epidemics, while scarlet fever, typhoid fever, smallpox, diphtheria, and chicken pox are usually so regarded. However, some of these are classed more generally as contagious diseases. All that can be said with certainty about epidemics is that at the beginning there must be some distempered conditions around us, and our systems be predisposed to the reception of the specific poison, which causes the disease.

EPIDERMIS (ĕp-ĭ-dĕr′mĭs), in anatomy, the cuticle or scarfskin, constituting the external layer of the skin and protecting inner ones. In man it is thickest on the palms of the hands and soles of the feet. It possesses an organized structure, but has no nerves or blood vessels. The outermost layer of cells covering the surface of plants, when there are several layers of tissue, is also called epidermis.

EPIGRAM (ĕp′ĭ-grăm), a name given by the Greeks to a poetic inscription on a public monument. It was applied originally to a short verse or poem having only one subject, and was finished by a witty or ingenious turn, but is now applied to any short composition expressed neatly and happily, as "The child is father of the man."

EPILEPSY (ĕp-ĭ-lĕp′sy), or **Falling Sickness,** a disease which derives its name from the suddenness of the attack. Usually the patient becomes unconscious and falls to the ground convulsed, turgid, and livid. This condition is generally accompanied by frothing at the mouth, a choking sound in the windpipe, biting of the tongue, and a suffocating tendency. After the patient reaches an exhausted, comatose condition, life is no longer in danger. Epilepsy may be caused by fear, passion, or an injury to the brain. In severe cases there is little hope of a cure, but patients may be afflicted with it from childhood until old age. Children often outgrow it at the period of adolescence.

EPILEPTICS (ĕp-ĭ-lĕp′tĭks), the persons afflicted with epilepsy. Within recent years considerable progress has been made in colonizing persons suffering with this disease, the purpose of which is to treat and care for them in the most satisfactory and efficient manner. The first colony for epileptics was established by Pastor von Bodelschwingh near Bielefeld, Germany, in 1867, and is known as the Bethel Colony. In 1890 the settlement contained, with its officers, physicians, nurses, and employees, about 3,600 persons. Under frugal treatment it has been possible to render much good to the unfortunates afflicted with the disease, the number of cured discharged at the end of each year aggregating twenty-one per cent. of the entire number treated, while about the same per cent. are discharged as incurable.

The marvelous development and success of the German colony led to a widespread movement in Europe and America to establish like institutions. Similar colonies are now located at Zurich, Switzerland; in Holland, France, and England, while the movement in the United States has attracted the attention of many State legislatures. The colony for epileptics in the State of New York is located at Sonyea; that of Pennsylvania, at Oakbourne; that of Massachusetts, at Monson; and that of New Jersey, at Skillman, though there are many others. Colonies of this class are usually located on farms comprising from 200 to 1,200 acres of land, on which the labor of those afflicted is utilized in facilitating the support. A late report shows that the number of epileptics in the

United States is 135,000, of which 9,500 are in Illinois, 12,500 in New York, and a proportional number in the other states and territories.

EPIPHANY (ĕ-pĭf'ă-nȳ), a festival of the Christian church, instituted to commemorate the visit of the Magi or wise men to the infant Jesus Christ, for whom they brought presents from the East. It is celebrated on January 6th and is sometimes termed the *manifestation of Christ to the Gentiles.*

EPIRUS (ĕ-pī'rŭs), a country of ancient Greece, surrounded by Illyria, the Ambracian Gulf, the Pindus Mountains, and the Ionian Sea. It corresponded quite nearly to modern Albania. Among the interesting towns were Donoa and Ambracia. The region was noted on account of its supply of heavy timber and the production of corn and domestic animals. Among the people were several colonies, the Grecians proper occupying largely the southern coastal district. Pyrrhus was the most celebrated king of Epirus and long waged war upon the Romans, but it finally became a province of Rome in 168 B. C. To prevent further insurrections the Romans plundered the country, razed seventy towns, and sold 150,000 of the people into slavery. It shared in the fortunes of the Roman and the Byzantine empires for many centuries, and was conquered by the Turks in the 15th century Since the 14th century a large per cent. of the inhabitants have been made up of Albanians. A small strip of land situated east of the Arta River was ceded by Turkey to Greece in 1881, along with most of Thessaly.

EPISCOPAL CHURCH (ĕ-pĭs'kŏ-pal), or **Protestant Episcopal Church,** a Christian denomination, the American branch of the Church of England. It became an independent ecclesiastical body in 1789, when it adopted its constitution at Philadelphia, Pa. It adheres strictly to the doctrine, discipline, and worship of the mother church, but the prayer book is altered so as to be consistent with the changes in the political condition of the country. Little progress was made in extension work until 1811, and within a period of ten years churches were organized in thirteen of the states. A movement toward suppressing the outward developments of what is known as ritualism caused extended controversies, especially in the general conventions of 1868 and 1874, and the two factions came to be known as the *low church* and the *high church* parties. Those opposing the ritual belong to the former, but the high churchmen are the dominant influence.

Changes in the prayer book or the constitution of the church can be made only by the general conference, which holds a session every three years. This body is composed of two houses, known as the house of clericals and lay deputies, and as the house of bishops. Within the United States there are 65 dioceses and 22 missionary jurisdictions, and an extensive line of missionary work is done in all the continents. In 1917 the church had 7,564 parishes and missions, 5,203 clergy, and 960,998 communicants. Among the organizations to promote Christian and charitable work are the Brotherhood of Saint Andrew, the Daughters of the King, the Church Temperance Society, and the Foreign and Domestic Missionary Society.

EPITAPH (ĕp'ĭ-tăf), an inscription upon a tomb or monument in honor or memory of the dead. The Egyptians first used epitaphs, usually with some prayer to Anubis or Osiris, and a similar custom was in vogue among the Greeks and Romans. Subsequently the practice became general throughout all Christian nations. The usual characteristic features in modern epitaphs are the name, date of birth and death, and some sentiment or expression of faith or affection. In many cases the sentiment is a quotation from the Bible, though epitaphs exemplify every variety of sense and taste, from lofty pathos to the vilest scurrility. Curious as it may seem, books containing collections of epitaphs are among the most amusing.

EPITHELIUM (ĕp-ĭ-thē'lĭ-ŭm), the layer of cells which lines the internal surfaces of the body, being continuous with the epidermis, which covers the external surface of the skin. Its main function is to act as a covering for the soft and moist surfaces that secrete the various fluids of the body. It lines the entire respiratory tract and the alimentary canal, and forms essential elements in the true glands, such as the pancreas and liver. The ciliated epithelium has hairlike projections known as cilia (q. v.), which have a continuous vibratory motion. Epithelium of this kind is found in the bronchial tubes, the air passages, the Eustachian tube, and the lachrymal appendages.

EPIZOA (ĕp-ĭ-zō'ă), the name given to parasitic animals which live upon the external surface of other animals, such as lice, itch insect, etc. See **Parasites.**

EPIZOOTIC (ĕp-ĭ-zŏ-ŏt'ĭc), an epidemic disease among animals. It is usually mispronounced in America as *ep-i-zoo-tic.* The very fatal contagious catarrhal fever which raged throughout the country in 1870 and at different times since was a form of the disease. Thousands of horses and cattle died at that time. Some pathologists claim to trace a connection between this disease and la grippe. See **Influenza.**

E PLURIBUS UNUM, meaning one out of many, the national motto of the United States. Adams, Franklin, and Jefferson were a committee to prepare a seal and proposed this motto, which was adopted on July 4, 1776.

EPOCH (ĕp'ŏk), or **Era,** a point in the course of history from which preceding and ensuing years are computed. The creation of the world and the birth of Christ are the most important epochs, and on the former are based

many notable chronologies. The *Era of Creation* is placed by Catholics and Protestants at 4004 B. C., the *Era of Constantinople* at 5508 B. C., the *Era of Antioch* at 5502 B. C., and the *Era of Alexandria* at 5492 B. C. In Jewish writings the creation is placed at 3760 B. C., on which the Jews base their era. The *Christian Era,* a mode of computing time from the birth of Christ, went into extensive use among Europeans about the year 1000, though it was introduced in the 6th century. The event of Christ's birth took place four years earlier than the date written in our calendar. The *Julian Epoch* begins with 4713 and is based on the coincidents of the lunar, solar, and indictional periods. Mohammedans compute time from July 16, 662, this being the anniversary of the *Hegira* of Mohammed. Among the Chinese it is customary to compute time by cycles of sixty years, and to apply a different name to every cycle.

EPPING FOREST (ĕp'pĭng), a beautiful pleasure resort near London, England. It comprises 5,600 acres of magnificent woodland, rises 760 feet above sea level, and is improved by many structures and conveniences. In early ages it formed a portion of the hunting ground of the kings, and constituted a part of the forest that covered all of Essexshire. The crowded populations of London utilize this resort extensively for pleasure walking and driving.

EPSOM SALT (ĕp'sŭm sąlt), or **Magnesium Sulphate,** a cathartic salt, so named because it was first obtained from the famous mineral springs of Epsom, a market town of England. It is soluble in water and is used as a purgative. This salt is obtained by an artificial process from magnesian limestone, the latter being treated with sulphuric acid, or by dissolving it in boiling water and allowing the insoluble matter to settle. Afterward the water is evaporated from the solution, leaving the salt.

EPWORTH LEAGUE (ĕp'wŭrth lēg), a young people's religious society of the Methodist Episcopal Church, organized in 1889. In 1925 it had 48,680 chapters and a membership of 2,563,780. The chapters are classed as *senior* and *junior,* about one-fourth of the members belonging to the latter class. The object is to promote an earnest, practical, intelligent, and loyal spiritual ife in the young people of the church, and corresponds to societies maintained for similar purposes by the Baptist, Lutheran, Catholic, Presbyterian, and other churches. It is the largest denominational society in the world. The *Epworth Herald* is the official organ.

EQUATOR (ē-kwā'tĕr), the great circle imagined drawn around the earth midway between the poles, and which divides it into the Northern and Southern hemispheres. The distance from it to the poles is 90°. It forms the basis for measuring the latitude of places both north and south. Twice in the year, on Sept. 21 and March 21, the rays of the sun shine vertically on the Equator, when the days and nights are equal all over the earth, from which the name *equinox* has been derived. The *magnetic Equator* of the earth corresponds quite nearly to the geographical Equator, and marks the point midway between the magnetic poles. On the Equator the magnetic needle is horizontal, and, as the poles are neared, the dip of the needle increases, while at the poles it points vertically downward. Lines connecting places which have the same angle of dip are *isoclinal* and correspond in a very remarkable manner to the isothermal lines, showing a dependence of the intensity of magnetism on the distribution of the sun's heat.

EQUATORIAL TELESCOPE (ē-kwā-tō'rĭ-ąl tĕl'ĕ-skōp) an instrument mounted upon a fixed axis parallel to the axis of the earth, which renders its motion parallel to the plane of the ecliptic. The principal axis turns upon a second movable axis, making it possible to continuously observe and note the right ascension and declination of heavenly bodies. Some equatorial telescopes revolve round the polar axis by an attached clockwork, which may be regulated to vary the velocity of rotation to meet the requirement in examining a particular heavenly body, such as a planet, a fixed star, a satellite, or the sun.

EQUESTRIAN ORDER (ĕ-kwĕs'trĭ-ąn), or **Equites,** an order of the people in ancient Rome. Originally they were a military organization and formed the cavalry of the army. Livy attributed their origin to Romulus, who is said to have selected the first three hundred out of the three chief divisions of the patricians. They were divided into *turmoe* of thirty men each and again subdivided into ten, and in the time of war were obliged to serve on horseback. The *equites* continued as an exclusively military body until 123 B. C., when a law was enacted that required that the jurors (*judices*) be selected from them. In addition they enjoyed the privilege of officiating as *publicani,* or farmers, of the public revenues. They wore a robe with a narrow purple border and a gold ring to distinguish them. During the republic they exercised much influence, but disappeared from the political life under the later emperors.

EQUINOX (ē'qwĭ-nŏks), the time at which the sun, in passing the Equator, renders the days and nights of equal length over the entire earth. This occurs when it enters one of the *equinoctial points,* the two equinoctial points being where the ecliptic and celestial equators intersect each other. The *vernal equinox* occurs on March 21, when the sun is in the first part of Aries, and the *autumnal equinox* takes place on Sept. 21, when it is at the first of Libra. At all other times of the year the length of the day and night is unequal, the greatest difference occurring at the poles. After the

vernal equinox, the sun passes from south to north, causing the days to lengthen in the Northern Hemisphere; while, after the autumnal equinox, it passes from north to south, causing the days to shorten in the Northern, but lengthen in the Southern Hemisphere. The precession of the equinoxes is due to the equinoctial points moving westward at the rate of 50″ in a year. The equinoxes, in March and September, are accompanied by gales which are known as *equinoctial storms.* They are most severe on the Atlantic coasts of America and Europe.

EQUITY, in law, a particular system of jurisprudence, which is based upon justice rather than precedent. It is sometimes defined as natural justice to distinguish it from the fixed and technical rules of law. In some countries, as in England, equity is administered by courts of chancery, but in some states the cases in equity are referred to the courts of law. The aim is to extend relief in causes which are not recognized in a strict sense by the law, hence the decisions are based upon modifying circumstances rather than upon the statutory law. Usually the plaintiff and defendant state their claim and defense in a formal statement, which is termed *pleadings,* and the question raised in this way constitutes the *issue.* In some instances the issues of fact are disposed of by the judge and jury, while in some countries the cases in equity are tried only to the court. In general, it may be said that courts of equity serve to bring all parties interested in a cause before the tribunal and adjust the rights of the several parties according to the circumstances which bear upon the issues.

ERA OF GOOD FEELING, the name applied to the period of United States history between 1817 and 1823, during the administration of President Monroe. At that time national political contests were suspended, the Democratic party had a large majority, and the Federalists had dwindled down to a very small number. It succeeded the War of 1812, when the new issues of tariff and internal improvements had not arisen, which soon after came into prominence and caused much political strife in Congress and the nation.

ÉRARD (ā-rär′), **Sébastien,** manufacturer of musical instruments, born in Strasburg, Germany, April 5, 1752; died in Paris, France, Aug. 5, 1831. At the age of seventeen he went to Paris, accompanying his brother, Jean Baptiste, to engage in the manufacture of pianos, producing his first instrument in 1777. Soon after the commencement of the French revolution he located a factory in London, but returned to Paris in 1796, where he became noted as a manufacturer of musical instruments. Among the inventions made by him are the grand piano, a double-action harp, and numerous improvements in the harp and piano.

ERASISTRATUS (ĕr-ā-sĭs′trā-tŭs), Greek physician, born at Iulis, in the island of Ceos, about 325 B. C. He was a pupil of Theophrastus and practiced for many years at Alexandria, Egypt, where he founded a school. The latter part of his life seems to have been spent at Samos in the study of anatomy. He was the first to distinguish between the motor nerves and the sensory nerves, and published a reasonably accurate description of the brain. In his writings he gives the view that the veins and arteries have their origin in the heart, hence he approached the discovery of the circulation of the blood.

ERASMUS (ē-răz′mŭs), **Desiderius,** philosopher and scholar, born in Rotterdam, Holland, Oct. 28, 1467; died in Basel, Switzerland, July 12, 1536. His name properly is Gerhard, meaning loved, though in accordance with the fashion among scholars of his age it was changed into the Latin and Greek equivalents. He studied at Deventer, where he displayed remarkable talents as a student of languages and literature. Later he entered a monastery near Delft and remained there as monk for six years. In 1492 he went to Paris to study six years, perfecting himself in theology and the humane sciences. He supported himself largely by giving private lectures. Soon after he went to England and became a student of Greek at Oxford under Finacre and Metcolet. Later he returned to Paris, enriched his knowledge by traveling in Germany and Italy, and became the teacher of Alexander Stuart, son of James IV. of Scotland, and with him visited numerous cities, but settled at Basel in 1514. In 1516 he published the first edition of the New Testament in Greek, this probably being his greatest work.

Erasmus took a middle ground on the issues of the Reformation, spending many of his later days in disputation with friends and foes, being unable to satisfy either party. The discussion with Luther on free will is among the most important, though there are many others from which he secured fame and consideration quite as lasting as were accorded to the more prominent men of letters. Many of the monarchs of Europe and others of influence and wealth sent him letters and presents as marks of friendship, and his correspondents included the most eminent men of learning. Among his writings are "Adagia," a collection of proverbs from the Greek and Latin, "The Christian Soldier's Dagger," "The Praise or Folly," a satire on kings and monks, and "Colloquia."

ERASTUS, Thomas, physician and theologian, born in the Canton of Aargau, Switzerland, Sept. 7, 1524; died Dec. 31, 1583. The real name of this celebrated man was Thomas Lieber, having translated it into the Greek according to the fashion of his time. He graduated at the University of Basel, traveled extensively, and later attained a doctor's degree at the University of Bologna. His writings and lectures

are numerous, and he exercised a marked influence upon medical theories and ecclesiastical and secular thought. He agreed with Zwingli on the doctrine of the Lord's Supper and insisted that the church cannot rightly excommunicate its members. Among his books are "On the Understanding of the Words of Christ" and "The Nullity of Church Censures."

ERCKMANN-CHATRIAN (ĕrk'măn-shätrē-än'), a compound name of two French-Alsatian writers of fiction. They formed a literary partnership in 1848, and together produced literary works known in all parts of the world. The partnership ceased in 1889, owing to differences over the division of the profits, though afterward the former friendship was reëstablished. Émile Erckmann was born May 20, 1822, in Alsace, now belonging to Germany, and died March 14, 1899. Alexandre Chatrian was born in Lorraine, Dec. 2, 1826; died in Paris Sept. 4, 1890. Both were educated in colleges of recognized standing, showed early aptitude for literary polish, and together produced their first work in 1848, a drama entitled "Alsace in 1814." The entire productions of the two writers include many volumes, and cover all manner of interesting topics, especially romances.

EREBUS (ĕr'ē-bŭs), in mythology, the son of Chaos and Night. He was changed into a river as a punishment for assisting the Titans. The term Erebus was frequently applied to a portion of the pagan inferno, a dark and gloomy space beneath the earth, through which the souls of the just passed on their way to enjoy the eternal and delightful life of Elysium.

EREBUS AND TERROR, the names of two volcanoes in the Antarctic region, located in the northern part of South Victoria Land. They were discovered by Sir James C. Ross in 1841 and were so named from the two vessels used in the expedition. Mount Erebus is 12,370 feet high and is situated 30 miles east of Mount Terror, which has an elevation of 10,900 feet.

ERECHTHEUM (er-ekh-thē'um), the name of a sacred edifice on the Acropolis, in ancient Athens. It was so named from Erechtheus, a fabulous hero of Greece, and it is thought to have contained the shrine of that hero and of Athene. The original building was burned by the Persians, but a new temple was built on the same site in 393 B. C. and dedicated to the Ionic order. It had three porticos and contained the sacred olive tree of Athene and a salt spring said to have been made by the trident of Poseidon. The ruins of this building, located north of the Parthenon, contain the Porch of Caryatides, in which six female figures somewhat larger than life support the entablature.

ERFURT (ĕr'fo͝ort) a city of Germany, in the Prussian province of Saxony, 145 miles southwest of Berlin. It is conveniently connected by numerous railroad lines with the important commercial and educational centers of continental Europe. The cathedral, a splendid Gothic structure, is one of the finest in Germany. This structure has a famous bell, the Maria Gloriosa, which weighs thirteen tons. The University of Erfurt was founded in 1378, but was suppressed in 1816, and now ranks as an academy of science. Its buildings have been well maintained and its library contains about 75,000 volumes. The monastery is now called Martinsstift (Martin's establishment) and has been converted into an orphanage. It was the residence of Luther from 1501 to 1508. The surrounding country is agricultural. The city has modern facilities and produces woolen, cotton, silk, and linen goods, machinery, tobacco, leather, chemicals, and scientific instruments. The city was founded in the early part of the 5th century, when it was called Erpesford from its founder, Erpes. In the Middle Ages it grew rapidly, became strongly fortified, and until 1873 was counted a fortress of second rank. Owing to its convenient location, it has been a point of contention by foreign invaders, became a part of Prussia in 1803, and was the seat of the celebrated congress of Erfurt in 1808, which was attended by the Emperor of Russia, Napoleon, and various German monarchs. Population, 1920, 111,461.

ERGOT (ĕr'gŭt), a fungus found in rye, wild rye, and other grasses, the principal symptom being that the seed, besides becoming black, grows elongated so as to resemble a rooster's spur, whence the name ergot comes. When the disease begins, sphacelae appear upon the pistils, and after a time a viscid fluid exudes from them. The disease is very fatal to the plants attacked, and, if eaten with sound grain, is dangerous to both man and animals. It causes contraction of the minute arteries by acting on their muscular walls, and is useful to check bleeding in parturition. In large quantities it produces nausea, delirium, stupor, and death. On the western plains it appears largely in wild rye, often causing much damage to large herds of domestic animals.

ERIC (ĕr'ĭk), the name of several Swedish kings, who ruled at different times between 1154 and 1568. The name is the Scandinavian form of Henry, and was applied to several monarchs who ruled Sweden and Denmark separately, though some governed the whole of Scandinavia after the Union of Calmar.

ERICSSON (ĕr'ĭk-sŭn), **John,** Swedish-American engineer, born in Långbanshyttan, Sweden, July 31, 1803; died in New York City, May 8, 1889. He became an engineer cadet at the age of twelve years, entered the Swedish army at seventeen, and was promoted captain in 1827. Subsequently he constructed a flame engine, which gained a prize at London in 1828, and soon after produced in rapid succession an instrument for sea sounding, a hydrostatic weighing machine, a tubular steam boiler, and

numerous other useful machines. He emigrated to the United States in 1839. In 1853 he built the ship *Ericsson* and invented a caloric engine by which to propel it. The screw propeller was patented by him in 1836 and came into use the following year. It was later employed by the United States government in propelling the warship *Princeton.* In 1851 he exhibited several philosophical instruments at London, including a sea lead, a pyrometer, and an alarm barometer.

JOHN ERICSSON.

The United States government employed Ericsson in 1861 to construct several ironclad vessels. Under this contract he completed the *Monitor* on March 9, 1862, which was successful in combating with the ironclad ram *Virginia.* This little vessel contained a turret operated by machinery so that guns could be fired in any direction. Though the subject of jests by sailors, who named it a "cheese box on a raft," it became famous and marked an epoch in the Civil War. In 1881 he built the vessel called the *Destroyer* for the United States government. Among his more recent scientific inventions is an instrument for making computation of the intensity of the solar heat and other influences affecting the rotary motion of the earth. In accordance with the request of the Swedish government and his own wishes the remains of Ericsson were taken to Sweden and buried at his birthplace. They were transferred with distinguished honors in the United States ship *Baltimore* to Stockholm. There they were received with like honors and carried to the last resting place under government escort. See **Monitor.**

ERIC THE RED, celebrated Norwegian navigator, who became associated with Icelandic explorations in 982. The following year he sailed westward from Bredifiord and discovered Greenland. After returning to Iceland in 985, he organized an expedition of discovery and with fourteen vessels reached the coast of Greenland. His son, Lief Eric, discovered the northeastern coast of North America in 1001, explored a portion of its coast, and named it Markland or Finland.

ERIE (ē'ri), a city in Pennsylvania, county seat of Erie County, on Lake Erie. It is on the Pennsylvania, the Buffalo and Erie, the Bessemer and Lake Erie, the New York Central, the Nickel Plate, and other railroads. The harbor is one of the best on Lake Erie, being the only harbor in Pennsylvania, and is protected by Presque Isle, a peninsula which forms a natural breakwater about six miles long. The city is midway between Cleveland and Buffalo, in close proximity to the coal and natural gas fields of Pennsylvania. It has a large export and import trade with the cities on the Great Lakes, being on the route of many steamship lines. The streets are well lighted and paved. They are lined with elegant mansions and beautified by fine trees and gardens. An abundant water supply is secured from the lake, the water being pumped into a tower 251 feet high, which is classed as the highest water pipe in the world.

Erie has an area of about twenty square miles. The noteworthy buildings include the county courthouse, the Federal building, the public library, and the high school. It has a number of fine public parks, a soldiers' monument, and several well-improved boulevards. Among the noted institutions are the Soldiers' Home, Saint Vincent's Hospital, Home for the Friendless, Erie Business College, Erie Stadium, Perry Memorial Building, Hotel Lawrence, and Saint Benedictine Academy.

As an industrial and jobbing center it holds a high rank. It has extensive machine shops, refineries, and foundries. The manufactures include fabrics, lumber products, tobacco, beverages, machinery, ironware, and hardware. Erie occupies the site of Presque Isle, a French fort built in 1753. The English captured it in 1760. In the War of 1812 it was the headquarters of Commodore Perry. The first settlers came here in 1795 and it was incorporated in 1805. Population, 1900, 52,733; in 1920, 93,372.

ERIE, Battle of Lake, a naval engagement of the War of 1812, fought near the island of Put-in-Bay, in the western part of Lake Erie, on Sept. 10, 1813. The American fleet under Commodore Perry consisted of nine small vessels, which had been built hastily at Presque Isle, and the British fleet under Commodore Barclay had six vessels. Commodore Perry used the *Lawrence* as his flagship, on which the British concentrated their fire and disabled it, hence he was compelled to shift his flag to the *Niagara.* The fighting became general and the British were compelled to strike their colors. Perry reported the victory to the government officials in these words: "We have met the enemy, and they are ours—two ships, two brigs, one schooner, and one sloop." As a result of the battle the Americans secured control of the Great Lakes and Northwest Territory.

ERIE CANAL, now known as the State Barge Canal, the largest and most important canal of the United States, extending from Buffalo to Albany, N. Y., a distance of 351 miles. The canal was first suggested by Gouverneur Morris and he was appointed at the head of a commission of seven members in 1810. The project was delayed by the War of 1812, but a law authorizing it was enacted in 1817, and the first canal boat passed through

from Buffalo on Nov. 4, 1825, Governor Clinton being a passenger on the same. This canal greatly revolutionized trade with the lakes and the interior, since railroads were yet unknown. By means of it the time of travel between Buffalo and Albany was shortened from twenty to ten days, and the freight per ton was reduced from $100 to $3. The canal as originally constructed was forty feet wide and four feet deep, and cost $7,602,000. In 1895 the sum of $9,000,000 was appropriated to deepen the canal to nine feet and otherwise improve it. However, the work cost more than twice that amount. Up to 1871 the propelling power consisted almost entirely of horses, though at that time steam-propelled boats were introduced, and at present electric motive power is used with success. However, the greatest share of freight is still carried in tow boats drawn by horses. The canal is twice carried over the Mohawk River on aqueducts, contains 72 locks, of which 57 are double-lift locks, and is considered one of the most scientific canals in the world.

ERIE, Fort, a fortified place in Welland County, Canada, on the Niagara River, nearly opposite the city of Buffalo, N. Y. It was occupied by the British under General Vincent, who abandoned and fired it with all its stores on May 28, 1813. The same day it was occupied by the Americans, who afterward withdrew from the Canadian shore, and the British rebuilt it. General Brown invaded Canada in July of the same year and required the fort to surrender. The fort was now strengthened by the Americans, and in August of the same year the British under General Drummond assaulted it and captured the main bastion of the fort, but a magazine blew up and rendered the attack unsuccessful. In November, 1814, the Americans finally abandoned Canada and Fort Erie was blown up.

ERIE, Lake, one of the five Great Lakes of North America, between lakes Huron and Ontario. It washes part of the northern boundary of New York, Ohio, and Pennsylvania, the eastern shore of Michigan, and the southern shore of the Province of Ontario. The discharges of lakes Superior, Michigan, and Huron flow into it through the Detroit River, while the outflow is into Lake Ontario by the Niagara River. Its width is from 30 to 65 miles; length, 260 miles, and area, 9,600 square miles. The Sandusky, Maumee, Detroit and Grand (in Canada) are the principal rivers flowing into it. Canal connections are maintained with the Hudson River by the Erie Canal, with the Ohio by the Ohio and Miami, and with Lake Ontario by the Welland. It has excellent fisheries and a large commerce. The naval victory gained by Commodore Perry over the British in the western part of the lake is commemorated by a monument at Cleveland and by a stone on the island of Gibraltar, near which the battle was fought. Among the chief harbors in the United States are those of Erie, Buffalo, Sandusky, Cleveland, Toledo, and Dunkirk. Those of Canada include Harrow, Rondeau, Port Rowan, and Welland.

ERITREA (å-rē-trā'à), or **Erythrea,** a possession of Italy, on the western coast of the Red Sea, extending as a narrow strip of country about 670 miles along the coast, from Nubia to French Somaliland. The area is about 50,500 square miles. It is inhabited chiefly by nomadic tribes of Arabs, but the southern part has some settlements of Afars or Danikils. A resident civil governor is nominated by the King of Italy and is under the direction of the Italian minister of foreign affairs. Farming is largely pastoral, its products being butter, meat, and hides, supplied by cattle, sheep, and goats. There are pearl fisheries of considerable importance along the coast, while the import and export trade is quite large. Massowah is the capital and local seat of government, with a population of 9,250. It is connected with Saate and several other points by railroad and telegraph lines. Numerous wars between the Italians and dervishes have occurred, though the boundary line was fixed at its present limit in 1897. Population, 1922, 279,551.

ERMAN (ĕr'män), **Adolf,** Egyptologist, born in Berlin, Germany, Oct. 31, 1854. His father was professor of physics in the University of Berlin, and he was educated at that institution and at Leipzig. In 1883 he was made associate professor of Egyptology at Leipzig, and two years later became director of the Egyptian department of history in the Royal Museum at Berlin, where he was appointed professor in 1892. Although he published many works of vast importance, his service to science is due chiefly to his work in the department of Egyptian grammar. Several of his publications have been widely translated and are considered standard texts. They include "Egyptian Grammar," "Formation of Plurals in the Egyptian," "Egypt and Egyptian Life in Ancient Times," "Flexion of Egyptian Verbs," and "Grammar of the Ancient Egyptians."

ERMINE (ĕr'mĭn), or **Stoat,** a small mammal allied to the weasel family, found in the

ERMINE.

northern portion of Europe, Asia, and America. The body in summer is reddish-brown above and white beneath, and in winter it is wholly

white, except the tip of its tail. Its body is about ten inches long, without the tail, which is about five inches. The fur is soft and silky and is used for ladies' winter garments, and in some countries for robes of kings, judges, and other high officials. When used as linings for cloaks, the black tufts of the tail are sewed to the skins at irregular intervals. The ermine lives in holes in the ground and under rocks, and feeds on mice, rats, birds, chickens, and other small animals, sucking the blood.

ERNE (ĕrn), a river and lake of Ireland, in Ulster County. The river rises in Lake Gowna and flows into Donegal Bay, passing through Lough Erne in Fermanagh County. It is sixty miles long and is navigable from Ballyshannon to the outlet. Lough Erne consists of two lakes, the upper and the lower, and is usually known as Lake Erne. It is rich in fish and eels, and the scenery is interesting and attractive.

EROSION (ē-rō′zhŭn), in geology, the influence of running water, waves, and wind in wearing away rocks and other substances. Immense quantities of silt are deposited at the mouths of rivers as deltas, which show that the geological structure of the earth's crust is changing from this agency. The erosion theory attributes the excavation of valleys and other depressions chiefly to the erosive power of water in the form of glaciers, instead of regarding them as due to depressions, cracks, or fissures in the strata produced by strains during upheavals through volcanic action.

ERRATIC BLOCKS, or Erratics (ĕr-răt′-ĭks), in geology, the boulders on the surface of the ground which have been transported from their original location by the action of glaciers and icebergs. They consist largely of granite, and in some cases were transported great distances from their original location. Many rocks of this class are found in the south central part of Canada and the north central part of the United States, extending from Saskatchewan through North and South Dakota and southward into Iowa.

ERSKINE (ĕr′skĭn), **Thomas, Lord**, orator and lawyer, born in Edinburgh, Scotland, Jan. 21, 1750; died Nov. 17, 1823. He was the youngest son of the Earl of Buchan, educated partly at Edinburgh and partly at the University of Saint Andrews, and entered the navy in 1764, though largely at his own displeasure. After serving in the navy four years and in the army seven, he entered upon the study of law at Cambridge, where he took a degree in 1778, and was called to the bar on July 3 of that year. His eminent success caused him to be elected to Parliament in 1783 for Portsmouth, which seat he held until he was raised to the peerage in 1806. He defended Stockdale, a bookseller, in 1789 on charges of libel brought for publishing a pamphlet in favor of Warren Hastings, in which his success in the art of addressing a jury was greatly admired.

Erskine lost the office of attorney-general to the Prince of Wales in 1792, on account of defending Thomas Paine, when the latter was prosecuted for publishing the second part of his "Rights of Man," though Erskine maintained the opinion that he deemed it right to defend a case even if not in full sympathy with the convictions and views of his client. The Prince of Wales, afterward George IV., made him keeper of his seals for the duchy of Cornwall in 1802, and in 1806 he was made peer and elevated to the dignity of lord chancellor. His speeches are unrivaled in the history of the British bar, and upon them rests his reputation. Among his publications are "View of the Causes and Consequences of the War with France."

ERYSIPELAS (ĕr-ĭ-sĭp′ĕ-lăs), an inflammatory disease of the skin. It is attended by fever and diffused redness and swelling of the parts affected, and later by peeling off of the scarf-skin in the milder forms, or by suppuration of the deeper parts in severer cases. There is usually considerable pain, with heat and tingling in the affected parts. The treatment consists for the most part in watching closely the progress of the case, keeping the bowels well regulated, and obviating special dangers as they may occur. Iron is sometimes used as a specific remedy. The disease is frequently an epidemic.

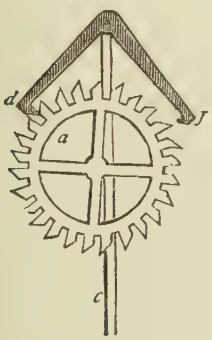
ERZERUM (ĕrz-rōōm′), a city of Turkish Armenia, situated in the southern portion of a wide valley, at an elevation of 6,200 feet, and surrounded by mountains of considerable elevation. It is the capital of a Turkish vilayet, which has an area of 19,180 square miles and a population of 645,728. The streets of the city are angular and the houses largely ancient, though there are numerous fine buildings, bazaars, and public edifices. The manufactures consist largely of ironware, clothing, copper, fabrics, and utensils. Erzerum forms an important strategical center. It has considerable trade with many points in Western Asia and the Persian pilgrims gather here in large numbers, when on their way to worship at Mecca. In 700 A. D. it fell into the hands of the Arabs, and was later successively conquered by the Byzantines, Mongols, and Turks. The Russians took possession of it in 1829 and again in 1878, though later restored it to the Turks. In 1916 the Russians, under Grand Duke Nicholas, after assaults lasting five days, captured it from the Turks. Population, 1922, 42,685.

ERZGEBIRGE (ĕrts′gĕ-bêr-gĕ), a range of mountains in Europe, trending a distance of 120 miles and forming a natural boundary between Bohemia and Saxony. The name in German means Ore Mountains and originated from the wealth of iron, copper, cobalt, lead, silver, coal, and arsenic found in the region. The culminating peaks in Germany attain a height of 3,850 feet and the average elevation is 2,500 feet.

ESARHADDON (ē-sar-hăd'don), a celebrated King of Assyria, son and successor of Sennacherib. He reigned from 680 to 667 B.C., during which time he became distinguished as a general and an organizer. His father had destroyed Babylon in 691 in the Babylonian wars, but Esarhaddon rebuilt it, making it his southern capital, and greatly extended his dominion. He conquered the country west as far as Cyprus, attained large possessions in Media, and made himself King of Egypt and Ethiopia. Later Manasseh, King of Judea, was conquered and carried captive to Babylon.

ESAU (ē'sạ), the founder of the Edomites, eldest and favorite son of Isaac, and twin brother of Jacob. He was a rough, cunning hunter, and seems to have cared nothing for the morrow, but lived in joyous carelessness from day to day. It is recounted that he allowed Jacob to defraud him out of his birthright for a dish of pottage, even though it carried with it the covenant blessing and many temporal advantages. When he learned that Jacob had deceived him, he vowed his destruction, and the latter was sent to live with his uncle, Laban, in Padanaram, for safety. Esau married two Canaanitish women and later married his cousin Mahalath, and established himself in the region of Mount Seir, in Palestine. He afterward became reconciled with his brother Jacob, who had returned home to the burial of his father.

ESCANABA (ĕs-kà-nạ''bà), a city in Michigan, county seat of Delta County, near the central part of the northern peninsula of the State. It is on the Chicago and Northwestern and the Chicago, Milwaukee and Saint Paul railroads, has a good harbor on Green Bay, and is an important shipping point. The chief buildings include the county courthouse, the high school, and the public library. Among the factories are machinery, iron foundries, and woodenware factories. Among the municipal improvements are waterworks, gas and electric lighting, sewerage, and street paving. It was settled in 1863 and incorporated as a city in 1883. Population, 1904, 11,098; 1920, 13,103.



ESCAPEMENT.

ESCAPEMENT (ĕs-kāp'mẹnt), a mechanical device intervening between the power and the time measurer of a clock or watch, and whose purpose is to secure uniformity in the rate of movement. It consists of two principal parts, the escapement wheel a and the lock d j, and through these the power imparts to the pendulum c, or balance wheel (time measurer), an impulse sufficient to overcome the friction and resistance of the atmosphere, and thus keeps up the vibration. These alternate motions of the lock serve to arrest and release the escape wheel at uniform intervals, thus governing the movement of the timepiece. The principle is the same whether the moving power consists of springs or weights. Among the different escapements in use are the chronometer, anchor, lever, cylinder, duplex, and horizontal.

ESCOBEDO (ås-kō-vā'thō), **Mariano,** Mexican soldier, born in Galeana, Nuevo Leon, Jan. 12, 1827; died in 1902. In 1847-48 he became celebrated on account of arming large numbers of Mexicans and attacking the United States forces engaged in the Mexican War, though later he fought with the Mexican army at Palo Alto. He is known by his daring exploits during French interference in Mexican affairs in 1862, and his resistance to the imperial general, Miramón, in 1867. The latter resulted in the capture of Emperor Maximilian and his shooting after a hasty court-martial. Escobedo was secretary of war under President Lerdo and opposed Diaz, which resulted in his arrest and trial by court-martial, though he was allowed freedom. In 1882-83 he held the office of president of the supreme military court of justice, but resigned in 1884 to retire from public life.

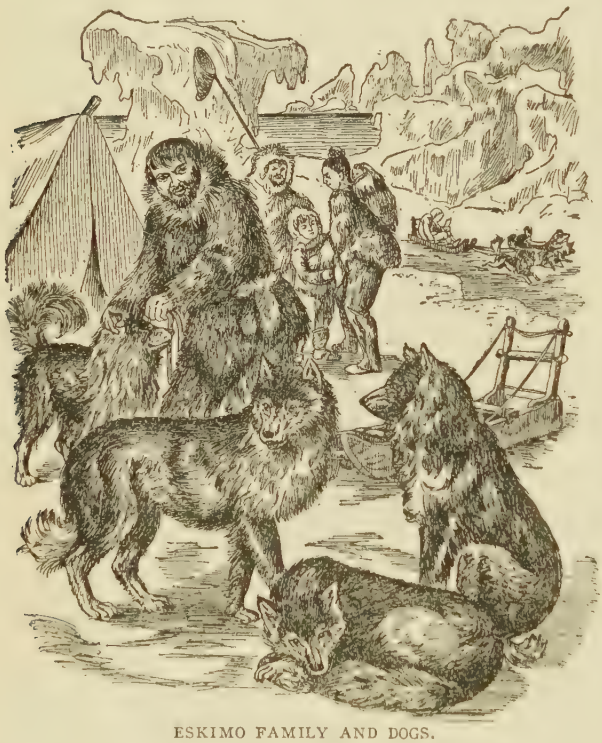
ESCURIAL (ĕs-kū'rĭ-ạl), or **Escorial,** a building about 30 miles northwest of Madrid, Spain, celebrated as a palace, church, convent, and burial place. It was built by Philip II. on a slope of the Sierra de Guadarrama, about 3,700 feet above sea level, and dedicated to Saint Lawrence in commemoration of the victory of Saint Quentin over the French on Saint Lawrence's day, Aug. 10, 1557. Since Saint Lawrence suffered martyrdom by being broiled to death on a sort of gridiron, its form is considered to be on the plan of a gridiron. The main building was begun in 1563 and completed after 21 years. This great building has a length of 740 feet, a width of 580, and a dome with a height of 220 feet. Its collection of pictures long ranked among the finest in Europe, but large numbers of the more noted were transferred to Madrid in 1837. A fire injured the library in 1691, but Ferdinand VII. restored it, and in 1808 the French army inflicted damages to the masonic portion. Marble tombs contain the remains of all the kings of Spain from Charles V. to Alfonso XII., except Philip V. and Ferdinand II., the tombs being in tiers over each other in niches constructed in the walls. A bolt of lightning struck the Escurial in 1872, by which serious damage resulted.

ESDRAELON (ĕs-drà-ē'lŏn), or **Plain of Jezreel,** a fertile valley of Palestine, extending from the Mediterranean toward the Jordan, along the eastern side of the Carmel range. It is drained by the Kishon River and noted for its present high state of cultivation, though prior to 1869 it was laid waste periodically by the

Arabs. This valley is the site of Gideon's victory over the Midianites and that of Napoleon over the Turks in 1799.

ESDRAS, Books of, the name of two apocryphal books of the Old Testament. They are usually given as the *First Book of Esdras* and the *Second Book of Esdras,* and generally appear as the first two books of the Apocrypha. The former contains a portion of *Nehemiah,* the *Book of Ezra,* and two chapters of *II Chronicles,* and was translated from the Hebrew. The latter, according to recent critics, was composed about the year 90 A. D., and was written in Hebrew or Greek. See **Bible.**

ESKIMOS (ĕs'kĭ-mŏz), or **Esquimaux,** a race of people supposed to be of Turanian descent, found native in the northern part of North America, Greenland, the Arctic islands, and the northeastern portions of Asia. The name applied to them is supposed to be of Indian origin, meaning *eaters of raw fish,* though the designation they applied to themselves is *Inu-it.* There are at least three principal divisions of this race—the Eskimo proper, in Labrador; the Greenlanders; and those occupying the country west of Baffin Bay and extending westward along the Arctic region to a district about 400 miles west of Bering Strait. Their height and coarse, black hair correspond to those of the American Indians, but the color of the skin shows a tendency toward brown. The eyes are often oblique, the cheek bones are prominent, the nose is flattened, and the weight is quite large considering the average height. Their summer residence consists of tents made with poles and skins.



ESKIMO FAMILY AND DOGS.

In the winter time the Eskimos build houses of snow and ice, though in some cases their habitations are permanent, being constructed of stone in which turf is used for cement. The food consists of the flesh of the walrus, whale, seal, and other animals, though this is usually eaten raw. They use a boat, or *kyak,* made of oiled skins with much skill. From fifty to several hundred inmates occupy a single house, which in the winter time is warmed by lamps consuming whale oil as fuel. The attire of the males and females is similar, consisting of trousers and a coat or sack, with a hood of skins drawn over the head.

Government among the Eskimos is tribal. The oldest are selected as chiefs, who officiate among the tribes and groups of tribes. Large numbers have been converted to Christianity by Danish missionaries, though some still adhere to totem worship. As hunters and fishers they show much skill with spears, arrows, and lances, these usually having bone or metal points. The Eskimo dog is their only domestic animal, and serves as a valuable help in hunting and drawing sledges. It is larger than the English pointer and has short, but strong, legs, and from its bushy tail has a wolfish appearance. By means of a team of trained dogs the Eskimo is able to travel sixty miles a day. The total number of Eskimos is now placed at 45,000.

ESKIMO DOG. See **Eskimos.**

ESMARCH (ĕs'märk), **Johannes,** surgeon, born at Tönning, Germany, Jan. 29, 1823; died Feb. 23, 1908. He studied at Kiel and Göttingen, served in the Danish War of 1848, and subsequently became chief physician of a hospital at Flensburg. In 1857 he was made professor at the University of Kiel, and served as physician general of the army in the Franco-German War of 1870-71. He was considered the greatest authority on gunshot wounds, and is the inventor of ambulances and the bloodless method of performing operations on the extremities of the body. Among his writings are "Contributions to Practical Chirurgery," "The Contest of Humanity Against the Woes of War," "Skillful Bloodless Operations," and "Handbook of Technical Chirurgery as Practiced in War."

ESPARTO (ĕs-pär'tō), a species of grass grown extensively in Spain and Northern Africa. It is especially valuable for its strong fiber, which is used in the manufacture of paper, maps, nets, and cordage. It has been acclimated in the United States and is grown to some extent as a commercial product.

ESPERANTO (ā-spā-rān'to), a universal language invented by L. L. Zamenhof, a scholar of Warsaw, Russia. He prepared an exhaustive grammar in that language in 1887, which has since been translated into about thirty of the leading languages, and a large number of publications are issued regularly to disseminate interest in its use. Esperanto societies are maintained in the leading cities of Europe and America. Regular courses of study are carried by many periodicals, such as the English *Review of Reviews.* The new language combines the more commendable features of the leading languages of Europe, in which respect it is superior to the Volapük (q. v.), and students may learn to read and speak it with facility in a comparatively short time. The English sentence, "The international language should be comprehensible to the whole educated world," appears as follows in Esperanto: "La lingvo internacia estas komprenita de la tuta mondo edukita."

Some one language has occupied a place of supremacy at all times. The Babylonian tongue was the language of diplomacy in the 2d century B. C. Alexander the Great made Greek the leading language, but it in turn gave way to Latin during the prosperity of Rome, which remained the language of scholars in Europe throughout the Middle Ages. French became the language of diplomacy in the 18th century. English sprang into use as the language of commerce in the 19th century, while German came to be indispensable to the scholar.

In a perfect system of communication each idea has its own separate symbol, as we find in the mathematical formulas and the chemical signs, but the connotation in the natural languages is very imperfect. English is the most imperfect in respect to spelling, while the inflected languages, as Latin and German, demand plural forms of the article, adjective, and verb with the plural nouns. An artificial language is intended to correct these and other difficulties. In Esperanto these faults are reduced to a minimum and each sound represents only one idea. Since it has no synonyms, puns are impossible in Esperanto. Those who have taken a leading part in the spread of the language maintain an organization known as the International Esperanto Congress. The general meeting of this body was held at Geneva, Switzerland, in 1925, at which about forty countries were represented by delegates.

ESQUIMALT (ĕs-kwī'mąlt), a seaport of Canada, in British Columbia. It is located on Vancouver Island, three miles southwest of the city of Victoria, on the Strait of San Juan de Fuca. The harbor is landlocked and contains a navy yard and a dry dock. Esquimalt is the headquarters of the British Pacific squadron, is strongly fortified, and is connected by railway with the coal mines at Nanaimo. Population, 1916, 3,845.

ESSAY (ĕs'sā), a literary composition shorter and less formal than a treatise, and which embodies the opinion of the writer on some general subjects. The term is sometimes used interchangeably with the word *treatise.* The writing of essays as a separate form of literature began in the 16th century, although such ancient writers as Plutarch and Cicero are rightfully classed with the essayists. Montaigne, the eminent French writer, may be credited as the father of the essays. Voltaire, Lamartine, and Rousseau are among the leading French essayists, and those of Germany include Lessing, Schlegel, and Hermann Grimm. The following list contains the leading essays of European and American literature:

Joseph Addison's....."The Spectator"
Matthew Arnold's....."Essays in Criticism"
Francis Bacon's....."Of Studies"
Thomas Carlyle's....."Sartor Resartus"
Ralph W. Emerson's....."Conduct of Life"
Hermann Grimm's....."Fifteen Essays"
Oliver W. Holmes's..."Breakfast Table Series"
Washington Irving's....."Salmagundi Papers"
Samuel Johnson's....."Rambler"
Alphonse de Lamartine's....."Confidences"
Charles Lamb's....."Essays of Elia"
Gotthold E. Lessing's....."The Laokoon"
John Locke's....."Essay on the Understanding"
James Russell Lowell's....."Among My Books"
Thomas B. Macaulay's....."Milton"
Jean Jacques Rousseau's....."Emile" and ["Confessions"
John Ruskin's....."Sesame and Lilies"
Friedrich von Schlegel's..."Philosophy of Life"
Henry David Thoreau's....."Walden"
Jean Voltaire's....."Essay on the Nations"

ESSEN (ĕs'sęn), a city of Germany, in the kingdom of Prussia, about twenty miles northeast of Düsseldorf. Numerous railroads and electric car lines connect it with cities at a distance. The streets are well paved and its architecture is durable and imposing. The cathedral, founded in 873, contains many treasures of art. Other noteworthy buildings include the courthouse, the town hall, the municipal theater, and many schools and hospitals. A fine monument of Alfred Krupp stands in front of the town hall. Among its industries is the celebrated Krupp steel and iron works, rated among the most extensive establishments in the world. These works were founded with only two workmen in 1827, but at present occupy a site of 1,000 acres and give employment to 45,500 workmen. The guns, steel plate, and munitions of war produced at this establishment are known in all the civilized countries. Other manufactures include clothing, fabrics, tobacco, earthenware, and machinery. The municipality maintains systems of sewerage and waterworks. Essen was founded in the 9th century, but its growth is comparatively recent. In the 17th century it was captured by the Dutch and the Spaniards. Since 1813 it has belonged to Prussia. Population, 1920, 294,629.

ESSEQUIBO (ās-sā-kē'bō), the largest river of British Guiana, rises in the Tumuc Humac

Mountains, and flows into the Atlantic near Georgetown. It has a course of about 600 miles and its estuary is 20 miles wide. Several tributaries flow into it, chiefly from the west, and the region through which it flows has fine forests of ebony, locust, ironwood, and greenheart.

ESSEX, the name of a United States frigate used in the War of 1812, then under command of David Porter. The *Alert,* a British sloop of war, commanded by Captain Laugharne, made an attack upon the *Essex* on Aug. 13, 1812, but was captured by its opponent. Later the *Essex* was attacked at Valparaiso, South America, by two British men-of-war, the *Phoebe* and the *Cherub,* and her crew was forced to surrender. This engagement took place on March 28, 1814.

ESSEX (ĕs'sĕks), **Robert Devereux, Earl of,** born in Herefordshire, England, Nov. 10, 1567; executed Feb. 25, 1601. He was schooled at Cambridge, entered military service in the Netherlands under his stepfather, the Earl of Leicester, and attained the special favor of Queen Elizabeth, who showed him many distinguished honors. Later he was sent to assist Henry IV. of France against the Spaniards and rose rapidly to privy chancellor, earl, marshal, and chancellor of Cambridge. His activities in military affairs resulted in the capture of Cadiz in 1596, but his expedition in the following year was not successful and caused a quarrel with the queen, in which he turned his back upon her and she promptly boxed his ears. Essex became so excited that he drew his sword, threatening the life of the queen, and the two were never really reconciled. In 1599 he was appointed Lord Lieutenant of Ireland, and, after failing in satisfying his constituents, he led a band of 300 men to rid the country of Elizabeth's counselors, but especially those opposed to him personally. Being disappointed in obtaining general support, he was captured, tried for treason, condemned, and beheaded. For some time Elizabeth showed unwillingness to sign his death warrant, expecting him to implore her pardon, but his pride and dignity prevented this. He was a friend of literary men, gave an estate to Bacon, erected a monument to Spenser, and contributed some productions in poetry to English literature.

ESTATE, the interest which an owner may have in property, either real or personal. The term *fee simple* is applied where the ownership is absolute, hence the owner may encumber or sell it as he may choose. An estate in *fee tail* is one which is owned by the possessor, but he may dispose of it only to his own issue. A *life estate* pertains to the ownership of land, but the title is held only during the lifetime of the possessor. In general, the term estate has reference to the degree, quantity, nature, and extent of interest which a person has in real estate. From this circumstance we speak of an estate in *expectancy,* in *remainder,* in *common,* in *reversion,* etc.

ESTHER (ĕs'tĕr), meaning a star, the Persian name of Hadassah, daughter of Abihail, and foster daughter of Mordecai, an officer of the Persian king, Ahasuerus. When the misconduct of Vashti had resulted in the loss of her royal estate, all the fair young virgins appeared before Ahasuerus that he might choose a successor. He selected Hadassah, who received the name of Esther on account of her loveliness. She saved the Jews, her people, from the horrors of a universal massacre, had Haman hanged, and caused Mordecai to be made chief next to the king. These events

ESTHER, Book of, a book of the Old Testament, so named from Esther, a Jewish maiden and the foster-daughter of Mordecai. It recounts how Esther was raised to the position of queen by Ahasuerus, King of Persia, that she and her uncle Mordecai frustrated the plans of Haman to extirpate the Jews, that Haman fell and was succeeded by Mordecai, and that a festival was instituted to commemorate the deliverance of the Jews from their enemies. Recent critics think that it was written about 640 B. C. The language of the original manuscript is Hebrew, intermingled with numerous Persian words. The purpose of the book is to illustrate that God takes care of His people.

ESTHETICS. See **Aesthetics.**

ESTHONIA, a republic of Europe, bounded on the north by the Gulf of Finland, east by Russia, south by Lithuania and west by the Baltic Sea. Formerly a part of Russia, it became independent in 1918. The area is 23,160 square miles. It is an agricultural country and produces chiefly grain, hay, cattle, potatoes and dairy products. Reval is the capital. Population, 1923, 1,768,480.

ETCHING. See **Engraving.**

ETESIAN WINDS (ē-tē'zhạn), the name of winds that prevail in the southern part of Europe during the summer season. They blow from the north and northeast across the Mediterranean, and are due to the sun heating the surface under the Tropic of Cancer, causing the air to be drawn in over the desert of Sahara. Though the air is charged with moisture in passing across the Mediterranean, the clouds are dispersed when they reach the margin of the hot sands and the vapor is dissipated in the rarefied air.

ETHELBERT (ĕth'ĕl-bĕrt), King of Kent, born about 545; died in 616. He succeeded his father in 560 and became the most powerful prince of the heptarchy. Christianity was introduced into Britain during his reign through the influence of his wife, Queen Bertha, who was a daughter of the King of Paris. At this time Saint Augustine flourished in England and through his influence many conversions were made. Ethelbert published the first written code of laws issued to the Anglo-Saxons.

ETHELBERT, King of England, son and successor of Ethelwulf, died in 866. He succeeded his father in 857 and became sole king after the death of his brother Ethelbald, in 860. The Northmen invaded England during his reign and sacked Winchester and Kent.

ETHELRED I. (ĕth'ĕl-rĕd), King of England, son of Ethelwulf, died in 871. He succeeded his brother Ethelbert in 866 and immediately engaged in a war against the Danes, who invaded and conquered a large part of his kingdom. He was killed in a battle with the Danes, at Reading, and was succeeded by Alfred the Great. See **England.**

ETHELRED II., King of England, son of Edgar, born about 968; died in 1016. He ascended the throne in 978 as successor of his brother, Edward the Martyr. He was called the Unready, on account of a want of vigor and capacity. His reign was marked by numerous incursions of the Danes. In 1002 he ordered all the Danes in England to be executed, the victims probably including Gunhild, the sister of Sweyn, King of Denmark. The latter promptly invaded England and ravaged the country for four years. A second war with Denmark broke out in 1015, when Canute, son of Sweyn, overran a large territory.

ETHELWULF (ĕth'ĕl-wo͝olf), King of the Anglo-Saxons, son and successor of Egbert, died in 858. He succeeded his father in 836 and most of his reign was disturbed by incursions of the Danes, who captured London in 851. Ethelwulf defeated the Danes at Okely, but they retained their settlement on the isle of Thanet. In 855 he visited Rome, where his son Alfred the Great received the sacrament of confirmation. On returning to England, he found that his son Ethelbald had usurped the kingdom. In order to adjust the difficulties, he granted the latter the government of Wessex.

ETHER (ē'thĕr), in astronomy and physics, the tenuous fluid that fills all space. It is regarded the medium for the transmission of light, heat, and electric action, through the molecules of solids and liquids as well as throughout all gases. This medium is thought to be more elastic than any ordinary form of matter. Electric and magnetic phenomena are but strains and pulsations in the ether. Physicists assume the existence of ether from the wave theory of the motion of light (q. v.).

ETHER, the name of a volatile liquid, usually divided into two classes known as simple ether and compound ether, or as ether and ethereal salt. These liquids are fragrant substances, burn easily, and have a wide use in medicine. Ether is employed in the solution of iodine, sulphur, phosphorus, strychnine, and other alkaloids. It is useful in the preparation of freezing mixtures. When inhaled, it produces intoxication. Sulphuric ether, so called from the use of sulphuric acid in its preparation, is employed to dissolve fats and resins. It is much used in medicine as a stimulant and anaesthetic.

ETHICS (ĕth'ĭks), or **Moral Science,** the science which relates to human duty. It investigates the nature and the right of conduct, actions, and aims, embracing the supreme good and the ultimate ground of obligation. Writers usually treat the science of ethics under two divisions—theoretical and practical. *Theoretical ethics* aims to ascertain the principles of the ideal moral manhood and life, while *practical ethics* applies these principles in directing man to the attainment of the ideal character and life.

Ethics as a science is frequently compared in various aspects to geometry. In geometry we have an intuitive idea of extension; then special forms of extension, as a line, a circle, etc.; and finally we arrive at intuitive truths called *axioms.* Similarly, in ethics we first have an intuitive idea of right; then an idea of particular forms of right, as kindness, honesty, etc.; and ultimately recognize certain principles, as "it is right to be kind," "it is our duty to be honest," which may be regarded *moral axioms.* Various systems of ethics have been proposed, all differing more or less widely in their conclusions as to the origin and nature of the faculty by which human duty is recognized. Many of the systems had their origin in antiquity, and with them the names of Socrates, Plato, Epicurus, Aristotle, and the Stoics are associated. With the introduction of Christianity ethical speculation turned on a new element, and among Christians moral obligation came to be based on the injunctions of the Scriptures.

Most modern writers regard the true, the beautiful, and the good as the three rational ideas of the mind, and of these the good, which is by some called the right, is held to be the highest idea. There has been a wide difference of opinion as to the question of right, the essential query being as to what it is that makes a thing right. Among the answers proposed are utility, highest happiness, divine law, the divine nature, and the eternal nature of things. Those holding to the view founded on *utility* urge that whatever is best adapted to the welfare of man is right, while the opposite things are regarded as wrong, because they retard the individual and the race in progress toward the ideal life. Those holding that right is based on the *highest happiness* of the individual similarly commend all that is essential to the happiness of man. By *divine law* is meant the revealed will of God, which some writers hold to be the ultimate right, but there is a wide difference of opinion as to what the revealed will of God is, which is likewise the case of the character of *divine nature.* Those holding that right is based on the *eternal nature of things* regard right and wrong as self-existent. Viewed from this aspect, they are said to have no origin, and that they are eternal.

The view that right and wrong are eternal principles is probably correct, since we cannot conceive a condition under which either can change or be terminated. When looked upon from this high plane, we conceive that right is wrapped up in the universe, one ever-existing ultimate principle.

Locke, in his "Essay on the Understanding," assailed the theory that morality is intuitive, and urged that there are no principles universally received among men, that children are not possessed of any moral rules, and that moral rules require a reason to be given for them, these all being conclusive that virtue is not innate. In reply to this view, writers have urged that all nations agree in enjoining some moral rule, but this is a departure from the original question, since we are to determine which of any opposite standards of morality is correct, as, for instance, monogamy or polygamy. Those who oppose the idea of innate virtue usually hold that the idea of right is the product of education. According to this view virtue depends wholly upon the manner of instruction, which likewise determines how the individual will class conduct in the categories of right and wrong. Others hold that education does not account wholly for the origin of the idea, but refer its development at least partially to instinct. In the philosophy of Kant, reason is held to recognize the obligation of right conduct, and action is classed as good only when it is done from a good motive, though the motive must be entirely freed from natural inclination to the act performed. Adam Smith, in his "Theory of Moral Sentiments," suggests that the sympathetic feelings of the impartial and well-informed witness of an act constitute the criterion of right, while William Paley (1743-1805) holds that virtue consists in doing good to mankind for the sake of everlasting happiness.

ETHIOPIA (ē-thĭ-ō′pĭ-ȧ), the Kush of sacred history, the ancient name applied to all the nations inhabiting the Southern Hemisphere, as known in early ages. However, some writers applied the name to the dark-brown or black-colored people, who are generally spoken of as Ethiopians, meaning *sunburned*. Later it had reference particularly to the country lying south of Egypt and the Red Sea, which corresponded to modern Abyssinia, Nubia, Kordofan, and other districts, though the boundary was not clearly defined. It was also applied to an island formed by two tributaries of the Nile, known as the kingdom of Meroë, whose capital was Napata. This island was fertile, producing an abundance of cereals, animals, and metals. It was given credit as the site of an oracle of Jupiter Ammon. Ethiopia, as a country, had a large trade with Egypt, Libya, Carthage, Arabia, and even India, but it attained its greatest prosperity about 1000 B. C., and formed a distinguished and powerful kingdom of ancient history. About the middle of the 8th century B. C. it became independent of Egypt, secured a predominating influence in the valley of the Nile, and imposed a dynasty on Lower Egypt.

The Persian Cambyses invaded Ethiopia in the 6th century B. C., though independence was maintained until it became a possession of the Romans in the reign of Augustus, the Ethiopian queen, Candace, becoming one of his vassals. The only evidences remaining of the ancient civilization of Ethiopia are numerous ruins of monuments and temples on which battles, religious ceremonies, and the industries are represented by sculptures. Their first king was Menelihek, who is supposed to have been the son of Solomon and the Queen of Sheba. The names of thirty kings and queens have been found sculptured on some of the ruins. Later the country came to be known as Abyssinia, but the monarchs of the present Abyssinia still designate themselves rulers of Ethiopia. The language of the Ethiopians, more correctly called the Geez language, was introduced from South Arabia, and formed the ancient ecclesiastical and official language of Abyssinia. Semitic in construction, it resembles the Hebrew, Aramaic, and Arabic. The modern nomadic tribes of the Sudan and Tigré speak a language quite closely allied to it. The literature of the Ethiopian language includes a translation of the Old and New Testaments and the Apocrypha, besides other important Christian literature.

ETHNOLOGY (ĕth-nŏl′ŏ-gy), the science which treats of the various races of mankind, investigates their distribution, and attempts to trace them to their origin. The science was developed from *ethnography*, which relates to particular tribes and localities, and to which it has a relation similar to the connection between geology and geography. *Anthropology* is the general science or natural history of mankind, of which ethnology and ethnography are important branches, while anthropology again is a branch of *biology*. In this article we can give only the leading facts of the unity or plurality of the species of mankind, since the whole study covers a wide range of details to be investigated. The distribution of man is much more general than that of lower animals, owing to the greater power of adaptation to change of circumstances. On account of this, man is found in all climatic zones and at all elevations above sea level, except only the small areas above the snow line.

The view that all mankind descended from a single family or species is the one most commonly supported. This view holds that Adam and Eve were the first parents, the common progenitors of all, racial differences now existing being attributed to climatic influences acting on individual families for a long period of time. Another view is that the various types have not descended from a single family, but

were created separately in different localities. The advocates of this theory maintain that the physical form, personal characteristics and general appearance of mankind could not have been so greatly diversified, as demonstrated by the different races, through mere climatic conditions. However, the difference in color, stature, size, and intelligence is largely overcome by the anatomical structure, which is invariably the same in all races. Besides, the racial differences are characterized by almost insensible gradation, which points to a gradual modification of an original race through changes in external circumstances, by means of which the principal species were produced. According to this view, it is assumed that all the varieties of races have descended from the Caucasian. Other evidences pointing to a single parent family are found in the similarity of earlier myths and legends, from which it is reasonably certain that the remote ancestors of the various races originally dwelt together. There is a close resemblance of the language of widely separated races, this being regarded the strongest proof of the early unity. By extended comparisons many scholars have been led to believe that the languages had their origin in the one parent nation, which dwelt in the neighborhood of Mount Ararat in prehistoric times.

Various classifications of mankind have been attempted. However, it has been difficult to find physical characteristics that belong exclusively to a single race, though there are some that predominate in certain races. The Dutch anatomist, Pieter Camper (1722-1789), attempted to make a scientific racial distinction by measurement of the facial angle. Though Camper's method illustrates nicely existing differences, they may be paralleled quite as distinctly by variations found in a single community. He classifies, for instance, the facial angle of the anthropoid apes at 42°, the African Negro at 70°, and the Europeans at 80°. J. F. Blumenbach (1752-1840), a German ethnologist, classified the human family into five races, basing the distinction on the differences found in the shape of the head, while Cuvier classified mankind in three divisions. As classified by this writer, the races are Caucasian, Mongolian, Ethiopian, Malay, and American, the two last mentioned being considered by him as subdivisions of the Mongolian. There is a more recent classification into three strongly marked types, the Caucasian, Mongolian, and Negro, and the three secondary races, the Malay, American, and Australian.

The *Caucasian* race is found in Southwestern Asia and most of Europe and America, and is widely distributed in small colonies in other portions. The *Negro* type prevails most largely in Africa and the *Mongolian* in portions of Eurasia not occupied by the Caucasian. Among the chief characteristics of the Caucasians are a round, oval face, fair complexion, arched forehead, symmetrical features, vertical teeth, smooth hair, and ample beard. The Mongolians have an angular face, broad head, oblique eyes, straight, coarse, black hair, high cheek bones, pale lemon to brownish-yellow skin, and a scanty beard. This race includes the inhabitants of most of Asia, the Laps and Finns of Northern Europe, the Magyars of Hungary and the Turks. The Eskimos, who inhabit the northern portion of North America and Northeastern Asia, are commonly classed with this race. The Negro race is characterized by a narrow and elongated head, projecting jaws, thick lips, crisp, curly hair, black or dusky skin, scanty beard on upper lip, and broad feet. It shows great differences in civilization, ranging from the cruel and vindictive Gallas to the debased Hottentots, from the cringing slave to most profound and enlightened scholars. This race is found in large numbers on the continent of Africa and has migrated to all portions of the warmer zones. The *Malay* race resembles the Mongolian. However, the eyes are horizontal, the hair is coarse and straight, and the skin is mostly a dark olive color. It is found in large numbers on the island of Madagascar, the southern Malay peninsula, and the islands of the Indian and Pacific oceans.

The *Australian* race is considered a sub-species of the Papuan branch of the Malays. It is characterized by deep-set eyes, large head, abundant beard, dark hair, and dark brown skin. In civilization it is wholly destitute and has shown little, if any, tendency to improve under a system of education. The *American* race resembles the Mongolian in some respects, though it is characterized by the top of the skull being more rounded and the sides less angular. This race once occupied all of America, though since the discovery and settlement it has been more or less assimilated. This is true especially of South and Central America, where the most highly advanced tribes of this race were found. At the time of discovery of America the people of the Andean plateaus were advanced in civilization, understood the art of working metals, and possessed remarkable temples, tombs, aqueducts, and pyramids, while those of Central America showed evidences of a still higher and more ancient civilization. The former probably were of Asiatic origin, while the latter have been traced by some writers to a Semitic or an Egyptian source. Placing the entire population of the earth at 1,500,000,000, the numerical strength of the different races is as follows: Mongolian, 650,000,000; Caucasian, 575,000,000; Negro, 175,000,000; Malay, 40,000,000; America, including all of the red race, 20,000,000; Australian and mixed races, 40,000,000.

ETIOLATION (ē-tĭ-ō-lā'shŭn), the process of bleaching plants by excluding the light of the sun. It is made use of in bleaching celery,

by which it is rendered quite tender and less acrid. Plants subjected to etiolation for some time become pale and almost colorless, since no chlorophyll is produced in the absence of sunlight. See **Chlorophyll.**

ETNA (ĕt'nà), a borough of Pennsylvania, in Allegheny County, on the Allegheny River, opposite the city of Pittsburg. It is on the Pennsylvania and the Baltimore and Ohio railroads, and has electric railway facilities. Etna has extensive furnaces, rolling mills, and machine shops. Population, 1920, 5,384.

ETNA, or **Aetna,** the most celebrated volcano in Europe, situated in Catania, Sicily, towering 10,865 feet above sea level. This mountain rises abruptly from the sea, having a circumference of over one hundred miles at the base, and ends in a single cone, in which a crater nearly three miles in circumference and 1,000 feet deep has been formed. A number of smaller cones are situated on the side of the mountain, the principal one being Monti Rossi, formed during the eruption of 1669. The mountain contains three climatic zones—the lower mild region, the central temperate, and the upper or snow covered. In the milder regions many varieties of lemons, oranges, date palms, olives, almonds, figs, and bananas are cultivated. The temperate belt has forests of oak, birch, chestnut, cork oak, maple, and pine, and in the upper part is a desert region covered partly with stunted vegetation and partly with ashes, lava, and sand, and much of it is buried most of the year with snow. A splendid view of the whole of Sicily, Malta, Calabria, and the Lipari Islands is obtained from the summit. At the height of 9,080 feet is an observatory, which is the highest inhabitated structure of Europe.

Several great eruptions of Mount Etna occurred long before the Trojan wars. They are related in the mythical writings of the ancients. The earliest to which a definite date is given occurred in 475 B. C. and the most remarkable overwhelmed Catania in 1169, when 15,000 persons were destroyed. In an eruption in 1329 a new crater opened. About a century later, in 1444, a large cone formation fell into the crater during an eruption, and in 1669 a chasm twelve miles long burst open and lava flowed over the country for forty consecutive days. An earthquake accompanied the eruption in 1693 and caused the destruction of 60,000 lives. Vast eruptions occurred in 1832, 1853, 1865, 1874, 1879, and 1923. Many less violent explosions took place at different times, numbering in all about one hundred, fully twenty of which occurred in the last century. Premonitory symptoms generally precede eruptions, thus giving ample warning to the people that danger is imminent.

ETON COLLEGE (ē'tŭn), an educational institution situated in Eton, England, about twenty miles from London. It was founded by Henry VI. in 1440, though its completion was retarded by political contentions until 1523. The institution is managed by a board or governing body, whose members are nominated by learned electors, including those of Oxford and Cambridge. Students from Eton may obtain valuable scholarships at Cambridge on merit, which is determined by competitive examinations. The buildings are substantial and convenient and associated with them are libraries, apparatus, a beautiful campus, and several parks. The attendance numbers about 1,000. Its courses of study are still based somewhat on the mediaeval idea that Greek and Latin are the basis of all good education. Among its distinguished graduates are Fielding, Fox, Chatham, Bolingbroke, Channing, Gray, Hallam, Wellington, Shelley, and Gladstone.

ETRURIA (ē-trōō'rĭ-à), the ancient name of the portion of Italy which is situated south of the valley of the Arno and west of the Tiber and the Apennines. In its greater prosperity it embraced the valley of the Arno, extending south of the Tiber, when it included the valley of the Po. For practical purposes it may be said that Etruria corresponded to modern Tuscany, but included several adjoining regions. The traditional history of the Etruscans begins about 1044 B. C., and its fairly authentic history precedes the foundation of Rome more than two centuries. The state was formed as a confederation of twelve great cities or cantons, each of which constituted a representative republic. Among the most flourishing of these cities were Cortona, Veii, Caere, Volsinii, Tarquinii, and Perusia. Veii was a rival of Rome for four centuries, and in its prosperity covered sixteen square miles, but was destroyed under Camillus in 396 B. C. The famous tomb of the Tarquins is located at Caere. Volsinii resisted Roman attacks for many years and constituted one of the most powerful centers of Etruscan strength.

The naval power of the Etruscans was a strong element in their prosperity, enabling them to control large portions of the Mediterranean, establish supremacy over central and northern Italy, and include Rome itself within their territory for several centuries. From them the Romans secured the circus, many arts of industry, architectural methods, and the gladiatorial combats. They formed an alliance with the Carthaginians in 538 B. C. for the purpose of expelling Greek colonists from Corsica, fought against the Greek colony of Cumae in 525 B. C., and were rated the greatest military power of Italy in 467 B. C., though two years later their strength was partly shattered by the Greeks. Subsequently their territory was invaded by the Gauls, Samnites, Greeks, and Romans. The Roman victory over Veii in 396 B. C. completely destroyed Etruscan power, while their last determined resistance ended at the Battle of Lake Vadimonian in 283 B. C. Even after this their

state was considered an independent ally of Rome, though Roman customs were gradually adopted until the final union was effected in 89 B. C., after which many of the leading families of Etruria attained to high positions in the Roman government.

The name applied to the people of Etruria by the Romans was *Etrusci*, while the Greeks called them *Tyrrheni*. These people constituted a sturdy race. They were characterized by black hair, a dark color, and a large head, and more nearly resembled the people of Western Asia than the Europeans. Their civilization was marked by culture, a definite literature, codified laws, and a flourishing commerce. Although their poems, dramas, and histories are numbered among the extinct writings of the past ages, we know something of their ability to compound and apply medicine, calculate mathematical and astronomical problems, mine and work metals, build highways, and construct architectural edifices by studying their ruins and deciphering the inscriptions found on monuments and in the tombs.

Many products of the Etruscans are extant, such as vases, lamps, and utensils. The vases made by this race are especially noteworthy, being ornamented by bands of beautiful foliage and figures of a highly artistic character. It is known from excavations that their homes were adorned with decorated walls, mirrors, jewelry, pottery, and convenient furniture, though in art they borrowed largely from the Greeks. Many of the exquisitely painted vases known and preserved as Etruscan were undoubtedly the production of Grecian workmen, for the reason that many of the inscriptions are in the Greek. The language of the Etruscans is known as Rasena and was spoken for about 1,000 years before the Christian era, when it gave way to the Latin. Numerous coins and gems bearing inscriptions in Rasena are extant.

ETRURIA, a kingdom founded in Italy by Napoleon I. in 1801. It comprised the territory of Tuscany and was governed by the Bourbons of Parma until 1808, when it was incorporated with the empire of France. Elise Bacciocchi, a sister of Napoleon, was made Grand Duchess of Tuscany in 1809, but it reverted to Ferdinand III. after the fall of Napoleon in 1814.

ETRUSCAN VASES (ĕ-trŭs'kạn). See **Etruria.**

ETTY (ĕt'tĭ), **William,** painter, born at York, England, March 10, 1787; died Nov. 13, 1849. He was apprenticed to a printer in Hull and studied painting at the Royal Academy in London. Subsequently he traveled in Europe, visiting the art galleries of Paris, Venice, and Florence. In 1828 he was made a member of the Royal Academy in recognition of his painting entitled "Pandora Crowned by the Seasons." His work has been criticised on account of many features being copied, though the composition and coloring have been commended. Among his chief works are "Head of a Cardinal," "Ulysses and the Sirens," "The Combat," "Joan of Arc," and "David's Chief Captain."

ETYMOLOGY (ĕt-ĭ-mŏl'ô-jў), that branch of philology which treats of the origin, form, and meaning of words. Numerous Greek philosophers, including Plato, the grammarians of Alexandria, the Roman Varro, and scholiasts of different ages, wrote on etymology and traced the origin and history of particular words and forms of language. In more recent times the intense interest given to the investigation of Sanskrit has led to its scientific study. By means of extended investigations language has been classed in groups and families and the similar and dissimilar words have been studied from the standpoint of relationship and origin. This has led to a recognition of the fact that the growth of language is not accidental or premeditated, but enlarges or declines under certain laws. In grammar etymology is the division which treats of the parts of speech, their inflections, and the elements of the sentences.

EUBOEA (û-bē'à), an island of the Aegean Sea, formerly called Negroponte. It is ninety miles long and thirty miles broad at its widest point, and is the largest island in the Aegean Sea. The narrow channels of Talanti and Egripo (*Euripus*) separate it from Greece. Much of the surface is fertile and well wooded, though several mountain peaks rise to a height of about 7,000 feet. Chalcis and Karysto are the principal towns and trading centers. Besides minerals, there are productions of live stock, cereals, and fruits. Euboea was settled by the Ionians in 1100 B. C., after which it became the home of Aristotle and the seat of the Euboean school of philosophy. Athens subdued it after the Persian wars and it became a possession of the Turks in 1470. It is now a province of the kingdom of Greece. Population, 1922, 107,218.

EUCALYPTUS (ū-kà-lĭp'tŭs), a genus of trees, mostly native to Australia, which grow to the height of 480 to 500 feet, and form one of the most characteristic features of the vegetation in that part of the world. The leaves, instead of having one of their surfaces toward the sky, often grow with each side equally exposed to the light. Many of the species abound in resinous secretions and are known as gum trees. The bark is thick and hard, containing a large per cent. of tannin. In the red gum, bay king, and iron bark species, a red juice flows freely from a wound and hardens into irregular, inodorous, transparent masses called *eucalyptin,* which is analogous to tannin. The wood is used extensively for shipbuilding. A species of the eucalyptus known as the blue gum tree has been introduced into Cape Colony, Algeria, Mexico, Roman Campagna, and elsewhere. The climate and soil of many parts of California

and Florida are well fitted for the cultivation of the eucalyptus tree, hence it has been introduced with good results. It has acquired a reputation for drying marshy soils and absorbing malaria, on account of which it is called

EUCALYPTUS.

the fever tree. A saccharine substance similar to sugar, a powder having the qualities of quinine, and a secretion resembling manna are obtained from these trees.

EUCHARISTIC CONGRESS, an institution of the Roman Catholic Church. The first meeting was held in Belgium, in 1881, and international meetings convened at regular intervals thereafter. The meetings in English-speaking countries include those held in Westminster, England, in 1908; in Montreal, Canada, in 1910; in Chicago, Ill., in 1926; and in Sydney, Australia, in 1928.

EUCHRE (ū'kẽr), a game of cards played by two, three, or four persons, but only the aces, kings, queens, jacks, tens, nines, and eights are used. The cards rank in the order named, except that the trump suit jack is called the *right bower,* which is the highest, while the jack of the next suit which is like in color is called the *left bower,* hence is the second highest card. The game is one of the most popular played with cards.

EUCLID (ū'klĭd), Greek mathematician, born in Alexandria, Egypt, about 300 B. C. He belonged to the Platonic school of philosophy and taught mathematics in the famous University of Alexandria, in the reign of Ptolemy I., where he made prodigious advancement by his vigorous methods. His "Elements of Geometry," published first in thirteen and later in fifteen books, has, perhaps, never been excelled.

EUDIOMETER (ū-dĭ-ŏm'ẽ-tẽr), an instrument used to determine the composition of gases. Priestley invented an apparatus of this kind to analyze atmospheric air and determine its proportion of oxygen. Many forms of the eudiometer are now in use, but the kind employed most extensively is a U or V shaped graduated glass tube, one end of which is closed and provided with electrodes fused into the glass. The air is tested by removing the carbonic acid contained in the air within the tube by means of a strong liquor potassae over a mercury bath, when the proportion of carbonic acid in the atmosphere is indicated by a rise of the mercury within the tube. An electric current is used, by means of the electrode, to explode a given quantity of hydrogen introduced in the tube. The volume of free oxygen in the tube is determined after cooling, and is equal to one-third of the loss of gas in the explosion. It is necessary to use a very thick tube in order to withstand the shock.

EUFAULA (ū-fạ'lȧ), a city of Barbour County, Alabama, on the Chattahoochee River, eighty miles southeast of Montgomery. It is on the Central of Georgia Railroad. The chief buildings include the high school and the Union Female College. The surrounding country is agricultural and fruit growing. It has manufactures of cotton goods, utensils, canned fruit, lumber, and tobacco. The municipality owns and operates the waterworks. Population, 1900, 4,532; in 1920, 4,939.

EUGENE (ů-gēn'), a city of Oregon, county seat of Lane County, 125 miles south of Portland. It is finely situated on the Willamette River and the Southern Pacific Railroad, and is surrounded by a fertile farming and fruit-growing country. The Willamette River furnishes excellent water power for manufacturing purposes. Among the manufactures are leather, lumber, furniture, brick, and flour. It is the seat of the University of Oregon and has a number of fine public schools and churches. Electric lights and waterworks are among the public utilities. The first settlement in its vicinity was made in 1854 and it was incorporated in 1864. Population, 1900, 3,236; in 1920, 10,593.

EUGÈNE, François, Prince Eugène of Savoy, noted general, born in Paris, France, Oct. 18, 1663; died in Vienna, Austria, April 21, 1736. Being the son of Eugène Maurice, he was intended for the church, but renounced his country on account of the banishment of his mother by Louis XIV., and entered the service of Emperor Leopold of Austria as a volunteer in the army sent against the Turks. His distinguished service caused his rapid promotion, and in 1693 he was made field marshal. Four years later he defeated the Turks in the Battle of Zenta, by which their power in Hungary was broken. When the Spanish War of Succession broke out, in 1701, he took a command in the army of Italy, but did not achieve much success on account of his force being too small. Shortly after he entered the imperial army of Germany and, in conjunction with Marlborough, in 1703, defeated the French. These commanders defeated the combined army of the French and Bavarians under Marshal Tallard at Blenheim on Aug. 13, 1704. He forced the French to raise the siege of Turin, Italy, the

following year, and soon after expelled their forces from Italy. In 1708 he attained much success on the field of Oudenarde against the French, and again at Malplaquet in 1709, though at the latter place he was dangerously wounded. After the recall of Marlborough, the activities of Eugène were somewhat limited, only to break out anew in 1716, when he defeated a Turkish army of 150,000 at Peterwardein with a force of 64,000 men, and in 1717 stormed Belgrade, gaining a decisive victory. After peace was declared, he served with distinction in the cabinet of Austria, attaining as much success in the deliberations of peace as in the activities of war. The popular songs of Austria long did honor to him and his posterity. History accords him a place among the greatest military heroes of modern times.

EUGÈNIE (ē-zhā-nē'), **Marie de Montijo,** Empress of France, born in Granada, Spain, May 5, 1826. She descended from Spanish and Scotch parents, was educated in Spain, France, and England, and attained to numerous accomplishments. Louis Napoleon, afterward Napoleon III., first met her in London, when he was there in exile. She went to Paris in 1851 and attracted the attention of the leading families, and on Jan. 30, 1853, married Napoleon. The wedding presents bestowed upon the contracting parties were exceedingly valuable. She expended $12,000 presented to her by the city of Paris for the purpose of endowing a college for women and used $20,000 of the amount given her husband for charitable purposes.

EMPRESS EUGÈNIE.

Eugènie, as the Empress of France, became a leader of fashion, maintained a brilliant court, and by taking an interest in politics endeavored to aid in furthering Napoleon's Mexican and papal policy. When Napoleon was in Italy, in 1859, she acted as regent. She was regent during his tour to Algeria in 1865 and again when he was at the head of the army in 1870. She fled to England as soon as intelligence of the surrender at Sedan reached her, and was joined there by her son and husband. Her abode in England was first at Chiselhurst, but later at Farmborough. Three years after removing to England Napoleon died, and her only son, the prince imperial, born March 16, 1856, was killed in the Zulu War in South Africa in 1879. He had received a military education in England and served as a volunteer in the English army, his death causing great sadness to his mother. She died July 11, 1920.

EULENSPIEGEL (oi'len-spē'g'l), **Till,** the name of a popular German story-writer, born near Lübeck in the latter part of the 13th century and reputed buried at Mölln in 1350. The book called "Eulenspiegel," meaning Owl's Mirror, so named in his honor, purports to contain his numerous whimsical stories and is the most popular chapbook of Europe. In it the love of fun is mingled with a profound love of mischief. It was originally written in Low German, but was soon after translated into High German and many other languages.

EULER (oi'lēr), **Leonhard,** mathematician, born at Basel, Switzerland, April 15, 1707; died Sept. 7, 1783. He studied at the University of Basel, where he graduated in 1723, and subsequently took up the study of theology and medicine. In 1733 he became professor of an academy in Saint Petersburg, and seven years later was called to Berlin by Frederick II. as professor of mathematics in the Academy of Sciences. He returned to Saint Petersburg in 1766, where he remained a potent factor in educational work until his death. His more important work consists of improving the integral calculus and science of mechanics. Many of his writings have been translated, especially his treatises on scientific and mathematical subjects. Among his books are "Treatise on Naval Science," "Letters to a German Princess," "Treatise on Dioptrics," "Theory of the Moon's Motion," and "The Science of Motion Analytically Explained."

EUPHRATES (ū-frā'tēz), an important river of Western Asia, rising by two head streams in the Anti-Taurus range, in Armenia. The western branch, known as Kara-su, rises about 25 miles northeast of Erzerum and joins the Murad Chai, the eastern branch, some distance to the southwest of that city. The great river is joined by the Tigris at Kurna, and the united streams take the name of Shat-el-Arab for the remaining distance to the Persian Gulf, into which its waters flow. The total length of the Euphrates is 1,740 miles, and the area of its basin is 260,000 square miles. It is navigable about 1,200 miles, though the larger warships cannot safely ascend farther than 125 miles, owing to rapids and shallows. During May and June vast floods are caused by the melting snows on the Taurus and the Anti-Taurus ranges, causing the current to rise in velocity from three to five miles an hour and often occasioning great floods. The Bible mentions the Euphrates as one of the four rivers of the Garden of Eden, in Gen. ii., 14. In the prosperity of Babylon extensive canals served in irrigating the flood lands. Nebuchadnezzar connected that city by canals with the interior, and converted the flood lands into the most productive district of the ancient world.

EURASIA (ū-rā'shĭ-ā), the region included

in the two continents of Europe and Asia. The term *Eur-Asiatic* is frequently applied to the geological formations of the two continents. In like manner, *Eurasian* has reference to both Europe and Asia, as the Eurasian plain.

EURASIANS (û-rā′shạns), the name applied to the people of India who descended from Hindu and European parents. They are the result of inter-marriages, and are usually educated in the manner of Europeans. Though they speak English quite well, their pronunciation is not clear and concise. Young men of this class engage in mercantile pursuits or enter the government service, and many of the girls marry British officers. The Eurasians have a much darker complexion than the Europeans.

EURE (ēr), a river of France, rises in the department of Orne, and flows into the Seine after a course of 115 miles. It receives the inflow from the Iton, its principal tributary, and is navigable about 50 miles.

EUREKA (û-rē′kȧ), the exclamation of Archimedes when he discovered a method of detecting the exact amount of alloy in the crown of King Hiero, the meaning being "I have found it." The word is now used to signify an expression of triumph at the time of making a discovery.

EUREKA, county seat of Humboldt County, California, on Humboldt Bay, 294 miles north of San Francisco. It has a good harbor and is on the Northwestern Pacific Railroad. The noteworthy buildings include the county courthouse, the Carnegie library, the high school, and several churches. Sequoia Park is a fine public resort and contains a tract of redwood forest in its virgin state. Among the manufactures are dairy products, lumber products, woolen goods, and machinery. It has a large export trade in wool, lumber, fruits, butter, and fish. The surrounding country is lumbering, mining, and agricultural. It was settled in 1850 and incorporated in 1856. Population, 1920, 13,212.

EUREKA, a city of Utah, in Juab County, 65 miles south of Salt Lake City, on the Denver and Rio Grande and the Los Angeles and Salt Lake railroads. It is surrounded by a productive gold, silver, and lead mining district. Near the city is a canyon of the Oquirrh Mountains, which is noted for its valuable silver mines. It has several fine schools and a considerable trade. Population, 1900, 3,085; in 1920, 3,608.

EURIPIDES (û-rĭp′ĭ-dēz), noted Greek poet, born in the island of Salamis, in 480 B. C.; died in Macedon in 406 B. C. He secured an elementary education, was trained in gymnastic exercises and rhetoric under Prodicus and philosophy under Anaxagoras, and formed a close friendship with Socrates. Writers credit him with completing his first play at eighteen, though the first publication, "The Daughters of Peleus," appeared in 455 B. C. The first prize was awarded to him in 441 B. C. and the last exhibit made was the "Oretes," in 408. Of the three great Greek tragedians he is the latest and by some is thought the most successful, the other two being Sophocles and Aeschylus. Socrates held his tragedies in high esteem and visited the theater at every performance of a play written by him, though Aristophanes did not admire him, owing largely to his opposition to introducing practical life into tragedy. He went from Athens to Macedon, where he joined the court of King Archelaus, and remained there until his death. When information of his demise reached Athens, there was mourning in the entire city. The actors on the stage of Sophocles wore mourning and the Athenians asked that his body might be buried in their city, though this request was refused by the Macedonian king. However, the Athenians built a tomb in his honor on the road to the Piraeus and inscribed it with "All Greece is the monument of Euripides: Macedonian earth covers but his bones." A splendid monument was erected to him by Archelaus in Pella bearing the inscription, "Never, O Euripides, will thy memory be forgotten."

The entire productions of Euripides, according to some writers, included 75, while others accord him 92. His knowledge of human nature, mastery of tragic situations, and skillful grouping of characters have led to a popular praise of his tragedies. They were the favorites of Aristotle, Ovid, Virgil, Horace, Milton, and Browning. Nineteen of his writings are extant, as follows: "Rhesus," "Alcestis," "Medea," "Hippolytus," "Hecuba," "Heracleidae," "Supplicex," "Ion," "Hercules Furens," "Andromache," "Troades," "Electra," "Helena," "Iphigeneia in Tauris," "Orestes Phoenissae," "Bacchae," "Iphigeneia in Aulis," and "Cyclops." Most writers regard the "Rhesus" as spurious, hence the authentic writings now extant number only eighteen.

EUROPA (û-rō′pȧ), in mythology, a daughter of Agenor, King of Phoenicia, and the sister of Cadmus and Phoenix. It is related that she gained the love of Jupiter, who assumed the form of a bull and carried her to the shores of Crete, where he took on a human form and married her. She became the mother of Minos, Sarpedon, and Rhadamanthus.

EUROPE (ū′rŭp), a grand division lying north of Africa and west of Asia, and with the latter forming Eurasia. From the standpoint both of history and politics it is the most important of the grand divisions. It is the most densely populated, but is smaller than any of the others, except Australia. The northern boundary is formed by the Arctic Ocean; eastern by the Ural Mountains, the Ural River, and the Caspian Sea; southern by the Black Sea and the Mediterranean; and the western by the Atlantic Ocean. The extreme northern point is Cape North; eastern, a point in Russia lying about 65° east of Greenwich; southern, Punta da Tarifa, in the Strait of Gibraltar; and

PHYSICAL MAP OF EUROPE.

western, Capt Finisterre, in the Iberian Peninsula. Its greatest length from north to south, between Capt Matapan and Cape North, is 2,400 miles, and the greatest distance from east to west is 3,400 miles; that is, measured from Capt Saint Vincent on the west to Ekaterinburg on the east. The total area is 3,782,000 square miles.

The coast line is characterized by a large number of indentations, hence it has a more irregular and extended coast in proportion to its size than any of the other grand divisions. Including the more important indentations, the coast line is about 25,000 miles, but it is nearly double that length if all of the indentations are followed. Many islands lie off its southern and western coasts. The former, which are the more important, include Ireland, Iceland, the British Isles, and the Faro Islands. South of Europe are Corsica, Sicily, Sardinia, Crete, Malta, the Ionian Islands, and the Balearic Islands. Numerous seas and inland waters abound near all of its coast line. These include Cheskaya Bay, the White Sea, the North Sea, and the Baltic Sea on the north; the Caspian Sea, the Black Sea, the Adriatic Sea, the Aegean Sea, and the Mediterranean on the south; while the expansive Bay of Biscay is on the west. The Mediterranean and other seas have arms extending far inland, such as the Sea of Azov, the Gulf of Genoa, the Gulf of Finland, and the Gulf of Bothnia. No lakes occur in the eastern part of Europe, and those of considerable extent are in the northern portion. These include Onega and Ladoga, in Russia, and Vener, Vetter, and Mälar, in Sweden.

Surface. The surface of Europe is characterized by a great plain extending from the Black Sea to the White Sea, and occupying the interior from the mountains in the south and west to the Asiatic boundary on the east. Its mountains form several complicated groups belonging to different geological ages, and occupy largely the southern and western portions. The most prominent system extends in a curved line from the Strait of Gibraltar along the Mediterranean to Asia Minor, and continues as the Caucasus Mountains between the Black Sea and the Caspian. This system is highest in the center, where the Alps attain a general elevation of about 12,000 feet, though Mont Blanc is 15,787 feet above sea level and forms the highest peak in Europe. However, Jungfrau, Matterhorn, and Monte Rose are but little inferior in height. Communication between the north and the south through these mountains is made possible by a number of famous railway tunnels, which include the Simplon, Mount Cenis, and Saint Gothard tunnels.

Several ranges extend from the central group, among them the Cevennes and adjoining ranges in France and the Cantabrian and Pyrenees in Spain, the latter containing peaks over 11,000 feet high. The system extends eastward in two curves to the Black Sea by the Transylvanian and Carpathian, which trend north of the Balkans and Dinaric Alps. North of the Alps are the ranges lying between the valleys of the Upper Danube and the Oder, and the different chains extending through Austria-Hungary. The mountains in the Scandinavian peninsula extend from the southern point of Norway to the Arctic Ocean, a distance of about 900 miles, the highest summit being about 8,000 feet. These ranges include the Kjölen and several broad plateaus that descend abruptly into numerous deep-cut valleys called *fiords,* and which are penetrated by the sea almost to the heart of the plateaus. The Ural Mountains extend along the boundary between Europe and Asia, in the north, and some distance to the west of the boundary in the center, trending on a line almost parallel to the meridians, and terminate in a plain north of the Caspian Sea.

Rivers. Most of the rivers flow in a southeasterly direction, and have their source either in the great central plain or in the mountains of the central west. The four largest rivers rising in the Alps are the Danube, Rhine, Po, and Rhone. Of these the Po flows into the Adriatic; the Danube, into the Black Sea; the Rhine, into the North Sea; and the Rhone, into the Mediterranean. These four rivers have large deltas. The central plain is drained toward the northwest by the Dwina and Petchora into the Arctic; by the Oder, Vistula, Duna, and Nieman into the Baltic; and by the Rhine, Weser, and Elbe into the North Sea. Toward the south and east it is drained by the Dnieper, Don, and Dniester into the Black Sea and the Sea of Azov, and by the Ural and Volga into the inland basin of the Caspian. Numerous rivers are found in all the peninsulas, the most important of these being the Tagus, Douro, and Gaudiana in Spain and Portugal; the Po in Italy; the Loire, Seine, and Garonne in France; the Ebro and Guadalquivir in Spain; and the Glommen in the Scandinavian peninsula.

In the northern part of Europe the lakes are frozen the greater part of the year, especially lakes Onega and Ladoga, in Russia, and Stor Lake, in Sweden, but the lakes of the south, though small, are important for their fisheries and as a basis for inland commerce. The most important of these are located near the Alps. Those south of the Alps include lakes Iseo, Como, Maggiore, Garda, and Lugano; those on the north include lakes Thun, Geneva, Zurich, Lucerne, Neuchâtel, and Constance.

Climate. The climate of Europe is peculiarly genial, though it is marked by periods of extreme cold in the north. The shores are exposed to the warm winds and warm oceanic currents from the southwest, by which the temperature is moderated and rendered favorable to the development of plant and animal life. As we proceed east the extremes of temperature

EUROPE
(Political)
SCALE
0 100 200 300 400 500
470 Statute Miles to one inch
Capitals of Countries ★ Other Cities
Comparative Area
KANSAS
82,158 sq. miles
ARCTIC OCEAN
ATLANTIC OCEAN
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
BALTIC SEA
NORTH SEA
AFRICA
ASIA
UNION OF SOCIALISTIC SOVIET REPUBLICS
ICELAND
NORWAY
SWEDEN
FINLAND
GREAT BRITAIN
IRISH FREE STATE
DENMARK
LATVIA
LITHUANIA
POLAND
GERMANY
FRANCE
SPAIN
PORTUGAL
ITALY
AUSTRIA
HUNGARY
CZECHOSLOVAKIA
ROMANIA
BULGARIA
GREECE
TURKEY
UKRAINE
CRIMEA
CAUCASUS MOUNTAINS
ARMENIA
Longitude West from Greenwich
Longitude East from Greenwich
Latitude North
7R25

become greater, the summer being hotter and the winter having greater cold. The most favorable effects of the oceanic currents are those experienced on the British Isles and the Scandinavian peninsula, in fact these otherwise would be almost uninhabitable. Northern Russia and the extreme north of the Scandinavian peninsula lie partly within the Arctic zone, and correspond in temperature to the extreme northern parts of North America.

As a whole, the climate of Europe is less severe in the western than in the eastern part, since the mean temperature is not perceptibly affected by the sea in the interior. At Sartov, in eastern Russia, the mean temperature is 41°; at Warsaw, 45°; at Berlin, 48°; and at Greenwich 49°. All parts of the grand division have an abundance of rainfall, but in some places it does not occur at the time of the growing season. This is true of Spain, where irrigation is resorted to in agriculture. However, rainfall is most abundant on the western coast and decreases toward the east in proportion of the increase of distance from the Atlantic.

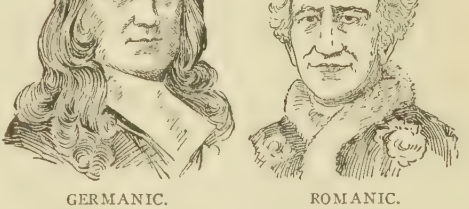
Minerals. Europe is rich in the useful minerals and many of these have been worked from times immemorial. Carboniferous coal deposits are abundant between the parallels of 40° and 60° north. They are worked with a high degree of efficiency in Great Britain, Germany, France, Belgium, Austria, and Poland. Iron ore is found in the same or adjoining fields. The output of iron is especially important in Spain, Germany, and Great Britain. Sweden has large deposits of superior steel-making ores, hence the products of this country are shipped very extensively. Nearly all of the world's supply of platinum is obtained from Russia, while sulphur is secured in large quantities from Sicily and Italy. In the production of gold in the world, Russia takes fourth rank, while Germany ranks fourth in the output of silver, and Spain and Portugal are exceeded only by the United States in the production of copper. Fine grades of marble are obtained in Italy, and granite, limestone, and other building materials are abundant in widely separated regions. Other mineral products obtained largely include petroleum, tin, quicksilver, and lead.

Vegetation. The great range of temperature makes Europe suitable for many species of plants. In the north, which extends beyond the Arctic Circle, the continent assumes the aspect of the tundra, where vegetation is very scant or entirely absent. Here thrive the saxifrage, crowfoot, poppy, scurvy-grass, and other forms common to the Arctic region. Forests of considerable value extend almost to Cape North, where the birch predominates, and farther south are fine forests of fir. The northern part of Russia and the Scandinavian peninsula do not yield cereals, but barley can be grown as far north as 70° north latitude and wheat thrives at about 60°. As we proceed south from this locality, we come in contact with fine forests of oak and beech and enter sections where all classes of cereals thrive.

Rye is grown extensively in many parts of Europe, while maize, oats, and barley yield abundantly. Rice is cultivated in some parts of Spain and Italy. Much attention is given to the culture of the mulberry in the vicinity of the Mediterranean. Many varieties of fruits thrive in the southern portion, such as lemons, oranges, vines, olives, almonds, and peaches, while the hardier varieties are cultivated extensively far into the north. The steppes of Russia are very similar to the great prairies of North America and extend as treeless plains from the borders of Holland to the Ural Mountains. They are especially rich in grasses and have been converted into a productive field for agriculture.

Animals. Formerly the continent was peculiarly rich in wild animal life, but it is now quite rare, except in the northern part and in regions under government protection. Polar bears and reindeer are numerous in the north, while wolves, foxes, bears, and lynxes infest the forests and mountains. Other species more or less widely distributed include the roebuck, ibex, porcupine, stag, and fallow deer. The fisheries are valuable, especially those bearing the cod, anchovy, salmon, mackerel, herring, and tunny. Much interest is vested in the rearing of domestic animals, hence the grades are superior from careful breeding. They are very similar in all sections of the grand division, except in the extreme north, where dogs and reindeer are used as animals of draft.

Inhabitants. The people of Europe belong to various races and are greatly intermingled in



GERMANIC. ROMANIC.

most of the states. At an early period the Celts occupied the region from the Alps to the British Isles, but they were driven westward by successive waves of migration under the Roman conquests and the insurrections of the Germanic tribes until they were pressed largely to the extreme west, or were assimilated by the most powerful divisions of the Germanic people. The Celtic language is represented at present only by the Gaelic in the islands of Scotland, the Irish in portions of Ireland, the Cymric in Wales, and the Armorican in Brit-

tany. Next eastward we find the Teutonic races, comprising the Germanic and Scandinavian divisions. In the former the Germans, Dutch, and English are included, while the latter comprise the Danes, Norwegians, and Swedes. Farther east the Slavonians are mixed with the Teutons to a greater or less extent. The different branches comprise the Russians, Poles, Bohemians, Czechs, Servians, Croatians, and other minor branches. The Greek and Latin people occupy the south and southwestern parts of Europe. Among the Latin, or Roman, races are the French, Spanish, Portuguese, and Italians. All the peoples named above are of the Aryan or Indo-European family.

The Mongolian race is represented in Europe by the Turks, Magyars, Lapps, and Finns, all these having emigrated into Europe within comparatively recent times and secured a foothold by successive conquests or friendly terms of settlement. Another class comprises the Basques, who are thought to belong to the Turanians. Owing to the great mixture of the population it is difficult to classify them on a racial basis; the better way is, perhaps, to base the classification upon languages. By this test it is found that the Teutonic language is spoken by 125,000,000; the Slavonian, by 110,000,000; the Roman, by 114,000,000; the Letts and Lithuanian, by 3,000,000; Armenian, by 1,150,000; Greek and Albanian, by 5,450,000; Celtic, by 3,600,000; and the non-Aryan, by about 18,000,000. Each of the languages has numerous dialects, though the number of distinct forms of tongues is about fifty.

The Christian religion prevails almost exclusively, the only exceptions being the Jewish in widely distributed but minor communities and the Mohammedan in Turkey. In the western part of the grand division various sects of the Protestant and Roman Catholic religion prevail, while the Greek Catholic is the predominating religion of Greece and Russia. Europe holds an important place in the field of education, but the advancement in educational lines has its greatest development in the Protestant nations of the western part, especially in Germany, England, and the Scandinavian Peninsula, where illiteracy has been reduced to a minimum. However, great universities are maintained in France, Austria-Hungary, Italy, and Russia, and the educational uplift in all the countries is marked.

Political Divisions. The countries of Europe as at present organized are governed wholly as independent states, and all of the more powerful nations have extended their political influence by the acquisition and control of territory in other grand divisions. The republics are Andorra, Czecho-Slovakia, Austria, Esthonia, Finland, France, Germany, Hungary, Jugo-Slavia, Latvia, Lithuania, Poland, Portugal, Russia, Switzerland, and Ukrainia. The monarchial governments are Albania, Belgium, Bulgaria, Denmark, Great Britain, Greece, Italy, Lichtenstein, Luxemburg, Monaco, Montenegro, Norway, Roumania, Servia, Spain, Sweden, The Netherlands, and Turkey.

History. According to some writers, Europe was named from Europa, a mythical person of Greece, who was carried off by Jupiter, though other authorities attribute its origin to the Phoenician traders, who applied it to the land of sunset, from the word *Erebh,* meaning darkness.

It is quite certain that Europe was first peopled by successive waves of migration that moved westward from Asia, each pressing the weaker farther and farther westward toward the Atlantic Ocean. The date of these great movements is unknown, though their occurrence is evidenced clearly by the present and past settlements in the European countries. Writers generally agree that authentic history dates in Greece from about 776 B. C. All the earlier periods are estimated from circumstantial evidence. The most successful epoch of Greece is assigned to about 430 B. C., and this date marks approximately the time when all colonies pressed westward. Grecian education moved westward to Rome and made it the predominating influence for many centuries. Greece was conquered by Rome in 146 A. D., and the latter soon made itself master of Spain, Gaul, Helvetia, Illyria, Dacia, and portions of Germany and Brittany. Roman extension carried superior laws, greater industrial activities, and social advancement to the regions conquered, and by its theory of government provided favorable conditions for the spread of Christianity. The northern nations migrated extensively shortly after the Roman Empire began to decline, and paved the way for great commercial and educational activities in the northwest. These movements were accompanied by the settlement of the Anglo-Saxons in England, the Franks in France, the Lombards and Ostrogoths in Italy, and the Visigoths in Spain, who by superior arts rendered the original inhabitants subject to their institutions or became assimilated with them.

A great Germanic empire was established under Charlemagne in 771. After the decline of the Holy Roman Empire, as the German nation came to be called, the territory was organized into the kingdoms of Germany, France, Burgundy, Italy, Lorraine, and Navarre. These movements were followed shortly by the populations of Eastern Europe establishing themselves in regions now more or less influenced by their occupation. The most prominent movements among them were directed toward establishing kingdoms in the north of Germany, Bohemia, Russia, and Poland, while the Magyars invaded Hungary and the Normans established principalities and governments in France, England, and various regions of the southeast.

The Christian Crusades, organized to rescue

GENERAL JOFFRE,
General of the French Army.

GENERAL HAIG,
the English Commander.

GENERAL VON HINDENBURG,
the German Commander.

GENERAL VON DANKL,
the Austro-Hungarian Commander.

ENVER PASHA,
the Turkish Minister of War.
(Opp. 950.)

GENERAL PETAIN,
the French Commander.

KING GEORGE V.

George V, King of Great Britain and Ireland and Emperor of India, succeeded to the throne on the death of his father, the late King Edward VII, in May, 1910. He was then in the forty-fifth year of his age. His wife, Queen Victoria Mary, is a daughter of the Duke of Teck.

Hon. William Lyon Mackenzie King, Prime Minister, Secretary of State for External Affairs and President of Privy Council. Elected Dec. 6, 1921. Studied at Toronto University, University of Chicago, and at Harvard. Minister of Labor, 1909–11; Member of Parliament; Succeeded Sir Wilfred Laurier as leader of Liberal Party, 1919.

KING ALBERT I.

lbert I, the third king of Belgium, ascended the throne n the death of his uncle, King Leopold II, December 17, 909. He is of democratic disposition, and stands first mong European monarchs as a financier.

(Opp. 950)

THE PRESIDENT OF FRANCE

Gaston Doumergue was born in Aigues-Vives (Gard) August 1, 1863. Elected to Chamber of Deputies, 1898, 1902 and 1906. In 1908–10 he was Minister of Public Instruction in the Clemenceau and first Briand cabinets. In 1913 became Premier. Elected President in 1924 to succeed Alexandre Millerand.

Jerusalem from the Mohammedans, exercised a wide influence on the habits and learning of the western peoples, while the Turkish conquest of Constantinople, in 1453, distributed the Greek teachers and philosophers throughout Western Europe. This caused a great impetus in the revival of learning, led to the invention of printing, and ultimately resulted in the Reformation. Spain became the most powerful nation shortly after the discovery of America. France soon after rose to a high plane of influence and the territories of Prussia and Russia were greatly enlarged and the sphere of their power was widened. A vast emigration to America greatly affected all the countries that had become over-populated and was the indirect cause of several extended wars. These conflicts were followed by the French Revolution, the Napoleonic wars, the dissolution of the German Empire, and the colonial development of several nations.

Among the more recent events in European history may be enumerated the independence of Greece; the absorption of Poland by several states; the unification of Italy; the consolidation of Germany into an empire; the establishment of the French Republic, as a result of the Franco-German War; the curtailing of Turkish influence by the independence of Bulgaria, Rumania, Servia, and Montenegro; and the War of 1897 between Greece and Turkey. The dissolution of the union between Sweden and Norway (1905) restored the independence of Norway. As a result of the Balkan War, in 1912-1913, Turkey lost much territory, Greece and the Balkan States were enlarged, and Albania became a kingdom.

In 1914 Europe was thrown into the greatest war of history, continuing over four years. Among the changes resulting from this war are the independence of Finland, Poland and Ukrainia; the establishment of Czecho-Slovakia and Jugo-Slavia; enlargement of France, Great Britain, Italy and Greece; the dismemberment of Austria-Hungary and Turkey in Europe; the weakening of Bulgaria, Germany and Russia; and the recognition of Japan and the United States as world powers. See **War,** page 666, Practical Home and School Methods.

EURYDICE (ū-rĭd'ĭ-sē), in mythology, the wife of Orpheus. She died from the bite of a snake and was followed by her husband to the lower world, where he charmed Pluto by his lyre so her release was obtained.

EUSEBIUS (ū-sē'bĭ-ŭs), **Pamphili,** church historian, born in Palestine, Asia, about 260; died about 340 A. D. He became Bishop of Caesarea about 314 and was a member of the Council of Nice. His writings include "Life of Constantine the Great," "Gospel of Preparation," and "Ecclesiastical History from the Christian Era to 324 A. D.

EUSTACHIO (ā-ŏŏs-tä'kē-ō), **Bartolommeo,** anatomist, born in Italy the early part of the 16th century; died in 1574. His birthplace and early history are uncertain, but it is known that he became a professor of medicine at Rome in 1562. He did much to advance knowledge in anatomy by discovering the Eustachian tube of the ear, which was named after him. He likewise added much to knowledge by describing the structure of the kidneys and the evolution of the teeth.

EUSTACHIAN TUBE (ū-stā'kĭ-ạn), in anatomy, the canal extending from the pharynx to the middle ear. Its function is to equalize the pressure of the air on either side of the tympanic membrane. In birds, reptiles, and mammals it is closely connected with the auditory organs. Diseases of the Eustachian tube impair the hearing.

EUSTIS (ūs'tĭs), **James Biddle,** soldier and statesman, born in New Orleans, La., Aug. 27, 1834; died Sept. 9, 1899. He descended from a Creole family, received a classical education, and graduated at Harvard Law School in 1854. Subsequently he practiced law in New Orleans, but at the outbreak of the Civil War entered the Confederate service as judge advocate of the staff of General Magruder and was transferred to the staff of General Johnston in 1862, with whom he remained until the war closed. Soon after he resumed the law practice, was elected to the Lower House of the Louisiana Legislature in 1872, and served in the State Senate in 1874-78. He was elected to the United States Senate as a Democrat in 1876, but resigned three years later to accept the chair of civil law in the University of Louisiana and was reëlected to the Senate, where he served from 1885 to 1891. President Cleveland appointed him ambassador to France in 1893, in which capacity he served with dignity and activity for four years. While residing in Paris he translated Guizot's "General History of the Civilization of Europe" from the French.

EUTAW SPRINGS (ū'tạ), **Battle of,** an engagement of the American Revolution, fought about sixty miles northwest of Charleston, S. C., on Sept. 8, 1781. General Greene commanded the American forces of 2,000 men, while the British under General Stuart numbered 2,300. The former made an attack at four o'clock in the morning and were victorious, but the British rallied and held their position until night, when they withdrew to Charleston. The Americans lost 554 and the British lost about 800. Though a tactical defeat for the Americans, it proved a strategic victory in that the British were shut up in Charleston.

EUTERPE (eu-ter'pe), in mythology, one of the nine Muses, the inspirer of delight. She presided over lyric poetry and played on the flute, of which she was the inventor. In sculpture she is usually represented as a virgin crowned with flowers, holding a flute or some other musical instrument in her hand.

EVANGELICAL ALLIANCE (ē-văn-jĕl'ĭ-kạl ăl-lī'ạns), an association of Christians of

various denominations. The first effort to form such an organization was made at London, England, in 1846, when a meeting was held by representatives of a large number of Protestant churches. About 800 persons were in attendance, representing the Baptists, Lutherans, Methodists, Presbyterians, Episcopalians, Moravians, and a number of other denominations. Among the countries represented were England, France, Germany, Ireland, Switzerland, and the United States. A branch was organized in America in 1867, and this is well represented in Canada and the United States. General conferences in the form of Protestant ecumenical councils represent officially the whole Alliance, but influence is exercised only to promote moral and spiritual lines of action. The purpose is to unify the Protestant missionary work, to coöperate along lines of Christian work without interference of denominational barriers, and to extend religious liberty in all parts of the world. This association has accomplished much good in obtaining reform and greater religious liberty in Japan, Russia, and Turkey.

EVANGELICAL ASSOCIATION (ăs-sō-sĭ-ā′shŭn), a religious denomination founded by Jacob Albright in Pennsylvania in 1807. He was a member of the Methodist Episcopal Church and traveled as an evangelist in the large German settlements of his native State, and carried on a line of effective work in promoting a higher religious life. The book of discipline does not differ in essential points from that of the Methodist Episcopal Church, which it resembles in polity, government, and methods of worship. In 1891 a division was made on account of a difference of opinion in regard to church government, which resulted in organizing the United Evangelical Church. This branch has about 40,000 members and the Evangelical Association proper has 125,000 communicants. The latter is represented by organizations in Canada, the United States, Germany, Japan, and Switzerland. Originally the members were exclusively German or of German descent, but now a large membership is English-speaking. Many charitable, missionary, and educational societies are maintained. The Young People's Alliance is an auxiliary organization.

EVANS, Oliver, inventor, born in Newport, Del., in 1755; died April 21, 1819. He invented the first steam road carriage ever worked in America, the high-pressure steam engine, and the automatic flour mill. In 1797 he wrote "Miller and Millwright's Guide" and "The Young Engineer's Guide."

EVANS, Robley Dunglison, United States naval officer, born in Floyd County, Virginia, Aug. 18, 1846; died Jan. 3, 1912. He served in the Civil War, was promoted to a captaincy in the navy in 1893, and the following year secured command of the cruiser *New York* and soon after of the battleship *Indiana*. In March, 1898, he was placed in charge of the battleship *Iowa*, which command he held during the Spanish-American War, and distinguished himself by taking a prominent part in the battle fought off Santiago, July 3, 1898. He was made rear admiral in 1901 and retired from the service in 1908. He published "A Sailor's Log."

EVANSTON (ĕv′ạnz-tŭn) a city of Illinois, in Cook County, about twelve miles north of Chicago, with which it is connected by surface and elevated electric street railways. It is on the Chicago and Northwestern Railway and on an elevated and several surface electric lines. The site is on a beautiful plat of ground on the margin of Lake Michigan. It is the seat of the Northwestern University, the Norwegian-Danish Theological School, the Garrett Biblical Institute, and the Visitation Academy. The streets are finely paved and lighted by electricity. Evanston was the home of Frances Willard. It was settled in 1835 and incorporated in 1890. Population, 1900, 19,259; in 1920, 37,215.

EVANSTON, a city of Wyoming, county seat of Uinta County, in the southwestern part of the State. It is located on the Bear River and the Union Pacific Railroad, and is surrounded by an agricultural and coal-mining district. The manufactures include flour and machinery. Mineral oil and building stone are obtained in the vicinity. It is the seat of the State institution for the insane and has a number of fine schools. Population, 1925, 3,507.

EVANSVILLE (ĕv′ạnz-vĭl), a city of Indiana, county seat of Vanderburgh County, on the Ohio River, about 160 miles northeast of Saint Louis. It is on the Louisville and Nashville, the Illinois Central, the Southern, and other railroads, and has communication by regular lines of steamboats. Productive coal fields are worked in the vicinity. It has a large shipping trade in coal, timber, brick and tile, flour, pork, grain, and tobacco. Among the manufactories are flouring mills, iron foundries, furniture factories, cotton mills, sawmills, bakeries, machine shops, and steam shovel works.

Evansville has regularly platted and well-improved streets. Much of the paving is of brick, stone, and asphalt. The chief buildings include the county courthouse, the Federal building, the Furniture building, and Willard library. It has a marine hospital, an insane asylum, and fine high schools. Sunset and Garvin parks are well-kept public resorts. Evansville was founded in 1816 and so named from Gen. Robert M. Evans. It was incorporated in 1847. Population, 1900, 59,007; in 1920, 85,264.

EVAPORATION (ē-văp-ō-rā′shŭn), the conversion of a liquid or solid by heat into vapor. Some solids, such as arsenic and camphor, pass into a state of vapor and are said to be sublimated. The rapidity at which evaporation proceeds depends upon the extent of surface exposed, for the reason that it takes place at the

surface; the quantity of the same vapor already present in the air, because when the air is saturated no more of the liquid can evaporate; on the removal of the air, because evaporation ceases when the air over the liquid is saturated; on the temperature, because warm air can hold more vapor than cold air; and on the pressure on the surface, since diminished atmospheric pressure increases the rapidity of evaporation. From every water surface and even from masses of ice and snow there is constantly arising, at all temperatures, an invisible vapor. A volatile liquid, when placed in a vacuum, rapidly evaporizes without external heat. If a drop of such liquid be passed into the empty space above the mercury of a thermometer tube, it disappears by changing into vapor. When the vapor more than fills the vacuum, the mercury is depressed, thus showing that it possesses tension. If more liquid be passed into the tube, it reaches a point when no more can be evaporated, but simply floats on the surface of the mercury. The vapor is then at its greatest tension and the space it occupies is said to be saturated.

The pressure remaining the same, there is for every liquid a certain temperature at which it boils. After it boils, all the heat it receives is rendered latent, and it can never be raised above that temperature while its vapor is allowed to escape. When vapor loses heat and condenses, the latent heat again appears as sensible heat. Thus, large buildings are heated by steam being passed through pipes, and, as it condenses, these pipes give out its latent heat. We are cooled by fanning because the warm air, thus brought in contact with the skin, causes a rapid evaporation of the moisture of the skin, thereby lowering the temperature. If water be placed in a vacuum space and the vapor which escapes from it be removed as rapidly as it forms, it is frozen by its own evaporation. Various machines used in manufacturing ice utilize this principle. The moisture taken up by the atmosphere in the form of vapor rises to considerable heights, forms clouds by partial condensation, and descends in rain when the point of saturation is reached.

EVARTS (ĕv'ẽrts), **William Maxwell,** lawyer and statesman, born in Boston, Mass., Feb. 6, 1818; died Feb. 28, 1901. He graduated at Yale, where he was joined by several others in founding the *Yale Literary Magazine*. Later he studied in the Harvard Law School and was admitted to the bar of New York in 1840. In 1860 he was chairman of the New York delegation in the Republican national convention, served as Attorney-General of the United States in 1868-69, and was counsel in the impeachment trial of President Johnson. He was counsel for the United States before the tribunal of arbitration on the Alabama claims at Geneva, Switzerland, in 1872. In the famous trial of Henry Ward Beecher, which took place in 1874, he was senior counsel, and served as counsel before the electoral commission in behalf of President Hayes. From 1877 to 1881 he served as Secretary of State, was elected Senator from New York for the term of 1885-91, after which David B. Hill succeeded him. Evarts, who ranked among the most eminent lawyers of America, was shown distinguished honors by several educational institutions, and published a number of addresses, among them the centennial oration at Philadelphia, a eulogy on Chief Justice Chase, and addresses delivered at the unveiling of the statues of Seward and Webster and the Bartholdi statue of Liberty.

EVELETH (ĕv'ẹ-lĕth), a city of Minnesota, in Saint Louis County, seventy miles northwest of Duluth, on the Duluth and Iron Range and the Duluth, Missabe and Northern railroads. It is surrounded by an iron-mining district. The chief buildings include a number of schools and churches. It has a large trade in merchandise and produce, and is important on account of the enterprises connected with the iron industry. Population, 1905, 5,332; in 1920, 7,205.

EVENING SCHOOLS, a class of schools established in many countries, generally in large cities, as a part of the public school system. The purpose is to give to those of school age, who cannot avail themselves of the advantages of the day school, an opportunity to obtain an elementary education and to enable adults, who have finished the course of instruction in the public day school, to acquire additional knowledge, especially on subjects relating to their particular occupation or profession. Schools of this class are now maintained in Austria, France, Germany, Great Britain, Switzerland, and other countries of Europe. In some countries they are supported at the expense of the state and are attended by both sexes, and the purpose is to furnish educational facilities for children employed in factories. Schools for the education of the children belonging to the industrial classes were formerly open on Sunday and evening schools more recently succeeded the Sunday schools, though in some countries the two are combined.

The evening schools of America may be said to date from 1850, when they were made an adjunct to the educational system in many large cities. They have been particularly proficient in teaching the English language to foreigners, and for that purpose many employ teachers who speak the language of the students. However, the main purpose is to teach the common school branches and to give instruction in commercial lines. The Drexel Institute of Philadelphia and Cooper Union of New York City are among the noted institutions that maintain evening classes for general and special instruction. Experience has demonstrated that evening schools constitute an essential part of every common school system, particularly in large communities, in which many children are obliged to leave the

day school before they acquire the rudiments of an education. The office of technical schools, while different, is no less important, since an increase of skilled labor in any community is one of the most valuable elements of its wealth and prosperity.

EVEREST (ĕv'ĕr-ĕst), **Mount,** the highest mountain peak in the world, situated in Nepal, Asia, among the great peaks of the Himalayas. Its height is 29,002 feet above sea level. The name was applied in honor of Sir John Everest (1790-1866), who was surveyor general of India.

EVERETT, a city of Massachusetts, in Middlesex County, in the extreme eastern part of the State. It is on the Boston and Maine Railroad and a number of electric interurban lines. The noteworthy buildings include the Whidden Memorial Hospital, the Parlin and Shute libraries, and the high school. It has systems of sewerage and waterworks, graded and paved streets, and a large trade in produce. The manufactures include bicycles, chemicals, baby carriages, furniture, hardware, and gloves. The surrounding country is agricultural. It was settled in 1643 and became a city in 1892. Population, 1905, 29,111; in 1925, 42,072.

EVERETT, a city of Washington, county seat of Snohomish County, on Puget Sound, about 35 miles north of Seattle. It is on the Northern Pacific, the Great Northern, and other railroads, and has a fine harbor. The customhouse, the public library, the high school, the county courthouse, and the theater are the chief buildings. It has extensive canneries, railroad shops, paper mills, machine shops, and steel mills. The public utilities include electric lights, sewerage, waterworks, and paving. It was settled in 1891 and incorporated in 1893. In recent years it has had a rapid growth in wealth and commerce. Population, 1900, 7,838; in 1920, 27,644.

EVERETT (ĕv'ĕr-ĕt), **Edward,** statesman and author, born in Dorchester, Mass., April 11, 1794; died Jan. 15, 1865. When graduating from Harvard College, he was accorded the highest honors, though only seventeen years of age. While at this institution he was the principal editor of the *Harvard Lyceum,* a college publication founded among the earliest in America. He became pastor of the Brattle Street Church in Boston when nineteen years of age, was appointed professor of Greek language and literature in Harvard, and later took a two years' course at the University of Göttingen, Germany, to prepare himself for the position. However, he resided four years in Europe and formed the acquaintance of many distinguished men, including Byron, Davy, Scott, and Jeffrey. He began his work as professor at Harvard in 1819, where he gave a course of lectures on Greek art and literature that was afterward repeated in Boston to large audiences. In 1820 he became editor of the *North American Review,* and during his editorship he contributed about one hundred excellent articles. He was elected to Congress in 1824, serving in the House for a period of ten years.

EDWARD EVERETT.

From 1835 to 1839 Everett served as Governor of Massachusetts and in 1841 was appointed minister to the court of Saint James. While serving in that capacity he secured several important treaties, among them an agreement by which American seamen obtained the right to fish in the Bay of Fundy. While resident in London he was granted degrees and shown distinguished honors by the universities of Cambridge, Oxford, and Dublin. Soon after returning to America he was elected president of Harvard College, in which capacity he served in 1845–48. On the death of Daniel Webster he became Secretary of State, and was chosen to the Senate of the United States by the Legislature of Massachusetts in 1853. The later years of his life most widely established his reputation and influence throughout America.

The oratorical powers of Everett were revealed in several excellent orations in behalf of peace during the conflict preceding the Civil War, the most noted being one on Washington, which he delivered in many parts of the Union. Applications for lectures came from many quarters, and people everywhere showed an eagerness to hear him. His expenses were wholly borne by himself, though tickets were sold to all auditors, but the funds were contributed toward the purchase of the old home of Washington at Mount Vernon, his contributions in this way amounting to $100,000. In 1860 he was nominated for Vice President on the ticket headed by Bell, though against his wishes. He delivered the address at the dedication of the national cemetery at Gettysburg in 1863. Among his principal works published are "Defense of Christianity," "Orations from 1825 to 1836," and "Orations from 1825 to 1850."

EVERGLADES (ĕv'ĕr-glādz), a tract of swampy land in the southern part of Florida, 150 miles long and 50 miles wide. It includes numerous marshy islets covered with dense thickets and groves of pines and palmettoes. Many shallow streams and lakes characterize the region. Formerly it was infested by vast numbers of alligators. The Everglades were made historical by the Seminole Indian War,

in which the chief, Osceola, took a prominent part against Gen. Andrew Jackson.

EVERGREEN, the trees and shrubs which retain their verdure through all seasons, as the fir, laurel, cedar, holly, cypress, juniper, etc. Evergreens usually shed their leaves in the spring, after their successors have reached a state of development, but in some instances a set of leaves lasts several years. The leaves are generally of thicker and firmer texture than those of deciduous trees, and the undiminished thickness of the foliage, characteristic of the northern scenery both in summer and winter, affords exceptional winter shelter for animals. Evergreens form very popular ornamental shade trees, and their boughs are used on festive occasions for decorative purposes.

EVERLASTING FLOWER, the popular name of various flowering plants, the bloom of which may be kept many years without a material diminution of beauty. They include the amarath, some species of cudweed, and a number of others. See **Immortelles.**

EVIDENCE (ĕv'ĭ-dens), in law, that which tends to prove or disprove any matter in question. It differs from the proofs by which human judgment is ordinarily determined in non-judicial matters, chiefly in certain rules established for the sake of felicity in disposing of complicated questions of fact, or of public policy, when by lapse of time or other causes there would be a deficiency of evidence. The rules under which evidence is admitted differ more or less, though in general they have many points in common, and for convenience are reduced under four heads, as follows: 1. Cases in which evidence is excluded on the ground of being untrustworthy and tending to show by its very nature that it likely is untrue. 2. Cases in which a rule is prescribed for the purpose of getting at a certain conclusion, though arbitrarily, when the subject is intrinsically liable to doubt from the remoteness, discrepancy, or actual defect of proofs. 3. Cases in which a legal presumption is substituted for actual proof, or in place of what could be proved, being supposed to be more consistent with the real rights of the parties than any result which could be expected from positive testimony. 4. The graduation of the weight of evidence, which will be found in some instances to be arbitrary in its origin, and, perhaps, not altogether in accordance with the ordinary process of judgment.

Evidence is usually studied under four heads: oral or documentary, direct or circumstantial, primary or secondary, and prima facie or conclusive. *Oral evidence* consists of statements made under oath by witnesses in court, while *documentary evidence* includes proofs in writing, which are submitted to the court or jury for inspection. *Direct evidence* is proof in itself of the existence of a fact, while *circumstantial evidence* is indirect, tending to show by circumstances that the fact sought to be established has existence. *Primary evidence* proves a fact by the best evidence obtainable, while *secondary evidence* is admissable only when primary evidence cannot be shown. For instance, when a case hinges upon a written contract, the agreement in writing must be produced if possible, but, if it is shown that it cannot be procured as evidence, then its existence may be proven by a copy or by oral testimony. *Prima facie evidence* is such as the law declares, or in fact appears, to be sufficient proof, while *conclusive evidence* establishes a fact and renders inadmissible any evidence to contradict it. While the rules governing evidence are very extensive, the essence of this branch of the law hinges upon what can be proved, rather than what is true.

EVOLUTION (ĕv-ō-lū'shŭn), in biology and geology, the steps by which organic and inorganic matter came to exist in their present forms. It is evident to every inquiring mind that times come when both the infantile and philosophic are led to ponder the question of the origin of things. In attempting to answer man has constructed a cosmogony which seeks to give an account of the origin of the universe. There are three classes of cosmogonies that merit thought. These represent that the world has existed in its present form from eternity; that the matter, but not the form, of the world existed from eternity; and that the matter and form of the world are due to a spiritual cause. The last two are termed evolution and creation, respectively. Evolution seeks to trace the growth of the world and the expansion of life forms from cause to effect, while creation disposes of the whole matter by attributing all laws of the universe, of life and being, to a divine godhead.

The very nature of the universe, with its varied changes through long periods of time, renders philosophies attempting to account for the laws that underlie cause and effect incapable of being grasped by even the highest effort of the intellect, and they are contradicted by various other philosophies and by the evidence of experience. The study of natural sciences has thrown light upon various questions relative to astronomical, geological, and biological phenomena. Through it have been fathomed many questions formerly incomprehensible, but there always remain conditions that point to a first cause which the most powerful intellect cannot comprehend. The theory of evolution involves a hypothesis which precludes a sudden and unexplained bursting forth of worlds and abrupt formations of physical laws to hold them in space, a miraculous springing up of life forms to inhabit and utilize nature's forces, but aims to account for all phenomena by natural laws, as the consequence of positive forces that operate under the will of a creator, or assume forms and undergo changes as the natural result of fitness. As a theory it superseded the crude

anthropomorphisms that did not recognize the growth of the universe as the unfolding of a cosmic drama, as a development under laws that bear scientific scrutiny.

In former times it was held that the universe is permanent and at rest, having neither motion nor sensible change. The static views of ancient astronomers gave way to those of Kepler, Copernicus, Galileo, Herschel, and Newton, by which a conception of the kinetic forces was recognized and the nebular hypothesis was established, which assumes to explain the commencement and motion of the planets and the sun by gradual condensation from a nebulous mist that occupied space. Geology led to a study of the earth's crust and to the belief that our sphere was once a globe of fire, which gradually contracted by cooling and caused the formation of an outer crust. The condensation of atmospheric waters gave rise to the oceans, which finally became confined to definite regions and left large tracts of projecting lands, and after successive ages rivers and mountains were formed.

That life existed during at least a large portion of the time required to form the earth's crust is demonstrated by fossil remains of animals and plants, which abound in many of the aqueous and metamorphic rocks. These rocks bear evidence that the lowest forms of life appeared first, and the higher gradually succeeded them and in many cases caused the disappearance of the earlier forms. The earlier animals were the protozoa, and after them, as if from evolution, came successively the radiates, articulates, mollusks, and finally the vertebrates. The earlier mollusks were followed by fishes, then came reptiles, later amphibious animals, and lastly mammals and man.

As a whole the fossil remains indicate that early life forms were general in character and gradually developed into the special; or, in other words, the evolution proceeded from the general to the particular, from the homogeneous to the heterogeneous. The changes were not abrupt, but proceeded gradually, one distinct form existing long periods of time after another had come into life. It is evident that the reptiles succeeded the fishes, though both existed afterward contemporaneously, and the reptiles were succeeded in a similar manner by birds. In this way the different forms of animals passed into each other by slight changes, though these effected very various results after long periods of time. In the process of evolution, rudimentary or useless organs gave way, and later became either entirely lost or existed only as an evidence of the changes that had previously occurred. To illustrate, the fins of a fish were small organs, though afterward they became modified as the wings of a bird, and later the paws of a dog, and still later the arms of a man. In the life forms still existing there are evidences of rudimentary organs, such as teeth rarely found in some birds, and hind legs concealed under the skin in some species of snakes.

All that is true of animal life in the process of evolution is true of plant life. The lower forms which prevailed at first gradually extended into other species and after successive changes multiplied into thousands of forms that exist at present. Besides, it must be borne in mind that there are fully as many extinct forms of plant as of animal life, the extinct species having been crowded out by others more nearly fitted to exist under the changed conditions of climate, and doubtless possessing greater ability to battle for place. In connection with this phenomenon may be mentioned the evolution of mind from the uncultured and crude to the alert, scrutinizing, and moral. In society mind has undergone a long line of evolution, by means of which it has acquired useful arts and has developed a higher life and a more complete civilization.

Among recent writers on the theory of evolution are Huxley, Haeckel, Darwin, and Spencer. Huxley speaks of evolution as the system that "embraces in one stupendous analogy the growth of a solar system from molecular chaos, the shaping of the earth from the nebulous cubhood of its youth, through innumerable changes, and development of a living being from the shapeless mass of protoplasm we term a germ." Spencer attributes all the changes of nature to three agencies—force, matter, and motion—while Haeckel traces both the vegetable and animal kingdoms to one very low form of life, consisting of a cell, and supposes this cell to be produced by or from inorganic matter by spontaneous generation. This he asserts to be possible for the reason that some forms of animal and vegetable life are so nearly similar that it is difficult to classify them. Darwin in his "Origin of Species" intimates his belief that life may have been originally breathed by the Creator into a few forms or into one, and that the others sprang from them in successive stages. See **Darwinism.**

EWALD (ā'vält), **Georg Heinrich August von,** orientalist and theologian, born in Göttingen, Germany, Nov. 16, 1803; died May 4, 1875. After securing a liberal education, he was made instructor in the gymnasium of Wolfenbüttel, and in 1831 became professor of philosophy in the University of Göttingen. While there he incurred the displeasure of the authorities for opposing the King of Hanover, who did not favor the constitution, and was removed in 1837 for expressing liberal political opinions. In 1838 he became professor of philosophy at Tübingen and after three years was appointed instructor of theology, in the teaching of which he came in conflict with the Hegelians, Pietists, and Catholics. He was again chosen professor at Göttingen in 1848, became a member of the North German parliament, and as such gave

active support to Protestant reforms. When Hanover was annexed to Prussia, in 1866, he refused to swear allegiance to the king of that country, for which he was removed from his position. No public man of his time wielded a larger influence as a scholar, and none made a deeper impression upon the thought of his generation. He published many works of vast importance, among them "History of the Jewish People," "Lexicon of the Hebrew Language," "Beginner's Book of Hebrew," "Antiquities of the People of Israel," and "Treatise of Languages."

EWELL (ū'ĕl), **Benjamin Stoddert,** mathematician, born in Washington, D. C., June 10, 1810; died in James City, Va., June 19, 1894. He graduated from West Point at the age of 22 years, and served with distinction as professor of mathematics and philisophy. In 1836 he became professor of Hampden-Sydney College, and later held like positions in Washington College and William and Mary College, accepting the presidency of the latter in 1854. After serving in the Confederate army, he was again elected president of William and Mary College, which position he held until 1888. Later he obtained favorable recognition from Hobart College and the Royal Historical Society of England.

EWELL, Richard Stoddert, Confederate soldier, born in Georgetown, D. C., Feb. 8, 1817; died Jan. 25, 1872. He graduated at West Point, served with distinction in the Mexican War, and later took part in the war against the Apaches in Mexico. At the beginning of the Civil War he resigned his commission as captain and entered the Confederate army, in which he attained to the rank of major general. While serving under Jackson, in 1862, he lost a leg, but after Jackson's death he took command of the second army corps and received the rank of lieutenant general. His services to the Confederate cause were especially valuable at Winchester, Gettysburg, in the Wilderness, and at Spottsylvania Courthouse. Later he was given command of the department of Richmond, and, after being defeated, he was taken prisoner, and his whole command was captured by Sheridan in 1865. His death occurred in Springfield, Tenn., where he settled after the war.

EWING (ū'ing), **Thomas,** statesman, born in Ohio County, Virginia, Dec. 28, 1789; died in Lancaster, Ohio, Oct. 26, 1871. At an early age he was taken to Ohio, where he worked in the Kanawha salt works, and secured a fund sufficient to enable him to graduate from the Ohio University. Later he studied law, was admitted to the bar in 1816, and entered upon a successful practice in the courts of Ohio and the Supreme Court of the United States. He was elected to the United States Senate in 1831, where he served six years, and later was made Secretary of the Treasury in the Cabinet of President Tyler. President Taylor appointed him Secretary of the Interior in 1849, being the first to hold that office after the creation of that department, which position he held until the death of the President. Later he was elected to the United States Senate, where he opposed Clay's compromise bill and the Fugitive Slave Law, and advocated the abolition of slavery in the District of Columbia. His views on national banks were antagonistic to the policy of President Taylor, but in his postal policy he was vigorously supported and was instrumental in securing many improvements in the service. He retired from the Senate in 1851 and resumed the practice of law in Lancaster, where he died twenty years later.

EXCHANGE (ĕks-chānj'), the division of economics which treats of the interchange of articles of value, as in commerce, or the transfer of commodities between different parties. The conditions peculiar to life confine the sphere of human activity largely to a particular place, while human wants are satisfied only by the productions from many different regions. From this localization of the efforts of man and the vast extent of his needs comes the necessity of transportation and trade. To be equitable, the exchange must be mutual and voluntary between two or more parties, and the right of property must exist. These are primary conditions, since transfer without a consideration is a gift, involuntary relinquishment is robbery, and no exchange can be effected unless the parties interested possess a right to the property exchanged.

The general law of exchange requires that value be given for value. In this connection the term *value* is used in a relative sense. It is defined as the estimate of the sacrifice requisite to come in possession of a desired object, and is sometimes spoken of as the *cost of production.* Hence, prices depend upon the *supply* and *demand* of a given article, or the quantity offered for sale on the one hand and the desire to possess on the other. It is understood that the desire must be more than mere longing, and must be attended by ability to purchase.

To promote exchange is one of the prime objects of government. In order to promote commerce and bring about the most beneficent results, legislation must aim to foster international and domestic trade, provide a wholesome monetary system, and regulate banking. It must guard against the evils which are likely to result from the monopolistic control of certain avenues of trade and transportation, as well as the limitation of certain lines of production for the purpose of controlling prices.

The term *exchange* is likewise applied to a class of transactions in commerce by which the debts of persons or corporations located in a distant city or country are canceled by a bill of exchange, as a check or draft, without the actual payment of money. This is effected by the payer depositing specie or its equivalent in

a bank for the purpose of forming a basis whereby the checks or drafts issued can be redeemed. The greatest volume, both of domestic and foreign business, is transacted by this system of exchange.

EXCISE (ĕk-sīz′), a tax levied upon commodities produced at home, as distinguished from customs or duties on imports. It is used generally in Great Britain to describe the system known as internal revenue in the United States. The excise system of England dates from 1643, when the Long Parliament levied duties to support the army against Charles I. After the restoration of the monarchy, it was continued, and subsequently it became widespread and oppressive. Sir Robert Peel headed a movement to repeal a number of the excise tax laws, and many of these duties were reduced or abolished after 1844. Excise taxes are levied in many countries upon beer, wine, tobacco, and cigars, such as are provided for by the laws of France, Germany, and the United States.

The first excise law of the United States was advocated by Alexander Hamilton and was adopted after an excited debate in 1790. It levied a tax ranging from nine to twenty-five cents per gallon upon liquors distilled within the country, and a higher rate was charged on imported liquors, but lower rates were established in 1792. Much opposition finally caused the Whisky Insurrection of Pennsylvania in 1794. The excise was abolished in the administration of Thomas Jefferson, but was revived during the War of 1812, when a tax was imposed on sugar, salt, liquors, carriages, and instruments of exchange. These duties were repealed in 1817 and no excise duty was levied until 1862, during the Civil War. This system was finally merged into the internal revenue, which continues to the present time. At the outbreak of the Spanish-American War, in 1898, the tax on tobacco and liquors was doubled and many proprietary articles were taxed. These were repealed in 1902, but similar tax laws were enacted in 1917, when war was declared against Germany.

The excise duties of Canada are levied chiefly on spirits and tobacco, in addition to which the manufacturers of these products pay a nominal license. However, both the duties and the licenses are preferential in favor of those who make the products from commodities produced within the country. The distiller pays a license of $250; the brewer, $50; the manufacturers in bond for exportation, $300; and the manufacturers of cigars and tobacco from Canadian products, $50, and when cigars and tobacco are made from imported leaf tobacco, $75. The tax per proof gallon on spirits is $1.90; on tobacco per pound, $0.05; on cigars made of domestic tobacco per thousand, $3; and on malt per gallon, $0.015.

EXECUTIVE (ĕgz-ĕk′ū-tĭv), the branch of a nation, state, municipal government, or corporation which controls the administrative functions. All free governments recognize three departments—the executive, legislative, and judicial—and no state can long exist without a distribution of its power and functions. The term *executive* is applied to the chief magistrate, whether he is a governor, president, king, or emperor, and extends more or less to the principal officers in all civil institutions. In the United States the chief executive power is vested in the President, who is assisted by a Cabinet which has advisory functions. The President is by the terms of the Constitution made ex-officio commander in chief of the army and navy of the United States and of the militia of the several states, when engaged in the actual service of the nation. The principal officer of each department of the government may be required to furnish to the President an opinion in writing on questions relative to public interest. With the advice and consent of the Senate, the President is empowered to make treaties and nominate certain civil, military, and naval officers of the United States. Besides the duties especially enumerated in the Constitution, it devolves upon the President to control the subordinate departments whose heads are known as Attorney-General, Postmaster-General, and secretaries of State, Treasury, Interior, War, Navy, Agriculture, and Commerce and Labor. The business of the government is carried on through these departments under the direction of the President, statutes are enforced, and special laws passed by Congress are put in operation.

EXETER (ĕks′ē-tēr), a city and river port of Devonshire, England, on the Exe River, about 170 miles southwest of London. The site is on the summit and slopes of a beautiful ridge rising 150 feet from the bank of the river. It is surrounded by an agricultural country and has many industrial enterprises. The modern utilities include steam and electric railways, stone and asphalt paving, and gas and electric lighting. Though dating from the early history of England, it has been outgrown by many newer cities. Among the manufactures are agricultural implements, machinery, clothing, paper, gloves, and Honiton lace. The buildings of interest include Saint Peter's Cathedral, Saint Michael's Church, Albert Memorial Museum, and the remains of the castle of Rougemont. A canal connects the city with the tideway and provides convenient access for ships and steamers. The city was founded before the invasion of the Romans, was captured by the Danes in 876, and was taken by William the Conqueror in 1068. A new theater building burned on Sept. 5, 1887, at which time 190 lives were lost. Population, 1907, 43,368; in 1921, 48,660.

EXETER COLLEGE, an educational institution located at Oxford, England, and formerly

called Stapledon Hall. It was founded by Walter de Stapledon and received its present name at the request of Edmund Stafford, Bishop of Exeter, who added two fellowships. Exeter College is a department or college of Oxford University.

EXETER HALL, an assembly hall with a seating capacity for 5,000 persons, situated on the Strand in London, England. It was completed in 1831 and in 1880 was purchased at $100,000 for the Young Men's Christian Association. Formerly it was used for religious assemblies of various kinds and for musical concerts. At present it is the headquarters of the local Y. M. C. A. and is let for religious assemblies.

EXHIBITION (ĕks-hĭ-bĭsh'ŭn). See **Exposition.**

EXODUS, the second book of the Pentateuch and of the Old Testament. It consists of two distinct parts, which include an account of the deliverance of the Israelites from Egypt and a description of the giving of the law. The book begins with the death of Joseph, recounts the oppression of the Hebrews in Egypt, the birth and call of Moses, the deliverance from Egypt, and the way to Sinai. It includes a description of the tabernacle, the wanderings in the desert, and the establishment of the Covenant with Jehovah. Tradition and evidence affirm the Mosaic authorship of the Book of Exodus, but it is questioned by a number of eminent scholars.

EXOGEN (ĕks'ō-jĕn), or **Dicotyledon,** a plant whose stem increases in thickness by successive additions on the outside of what surrounds the central pith. The structure is best seen in the bodies of trees having a central pith, which is surrounded by as many concentric layers as the tree is old in years and the whole is inclosed by a cylindrical sheath of bark. Rays called medullary radiate from the central pith to the bark. Exogens have two seed leaves, or cotyledons, and are now generally called *dicotyledons.* The leaves, with a few exceptions, are reticulated, while the flower usually has four or five parts. In all these respects exogens differ from endogens. The greater number of the trees in tropical climates and all of those in cold regions are exogens.

EXPANSION (ĕks-păn'shŭn), in physics, the increase in bulk which a body undergoes in consequence of a change in its temperature, so that it occupies a greater space while the weight remains the same. Heat is the most common cause of expansion. Water in cooling ceases to contract at 39.2° Fahr. and, in lowering its temperature, it expands again until frozen, when the expansion reaches about one-eleventh of its original bulk. Thus water, when at its greatest density, which is at 39.2° Fahr., presents the curious phenomenon of expanding whether heat or cold be applied. Expansion is common to all substances, though gases expand more than liquids, and liquids more than solids. It is due to this force that wagon tires are made somewhat smaller than the wheel. Hence, when heated, they may be slipped on easily, and in cooling contract sufficiently to hold the parts of the wheel securely together. Winds are caused by the air expanding under the heat of the sun, and the phenomenon of oceanic currents is due to the same cause.

EXPLOSIVES (ĕks-plō'sĭvs), the substances which may cause an explosion by their sudden combustion or decomposition. The remarkable fact that explosives will not explode in vacuums was discovered early after gunpowder came into use, though the first definite experiments made in this connection were those of Priestly more than a century ago. These experiments were effected by placing gunpowder in vacuums and heating it by concentrating the sun's rays on it with a lens or burning glass. Some writers have expressed the opinion that the discovery of explosives has been, next to that of printing and the application of steam power, the most valuable. It is true that their utility in the arts of peace is very important, as otherwise the vast engineering enterprises of modern times would have been entirely impossible or required a vast additional expenditure of time and labor.

As a matter of convenience, explosives are classed as explosive mixtures and explosive compounds. *Explosive mixtures* are those that can be separated more or less completely by mechanical means not involving chemical action. In a separate condition the ingredients, as a rule, do not possess explosive properties. *Explosive compounds* are chemical compounds or chemical combinations which possess a definite explosive molecule, and contain both the combustible and the supporter of combustion in a closely united form. Most explosive mixtures require a particular period of time for combustion, while in explosive compounds the action is much more sudden and violent. Among the list of explosives may be classed gunpowder, nitrate mixtures other than gunpowder, chlorate mixtures, compounds containing nitroglycerin, and gun cotton. To these may be added the nitro-substitution compounds, including picric powders, springel explosives, and fulminates. Aside from these are numerous compounds that may be grouped with each of the above classes, all more or less valuable in war, for mining, and for purposes which require the sudden development of a powerful force. Some of the newer explosives that have gone into use are smokeless, or are unaccompanied by a loud report at the time the explosion takes place. The newer list of explosives also includes melinite and trinitrotoluene; the latter is made from totuene and its high explosive force renders it valuable in charging shells. See **Gunpowder.**

EXPOSITION (ĕks-pō-zĭsh'ŭn), a national or international exhibition of the works of art

and industry for the purpose of stimulating public interest, promoting manufactures, and expanding trade. The first great industrial exposition of the world was held at Paris in 1798, and its success caused a similar display of French industries to be made in 1802. The effects of these expositions were so widespread and the results so beneficial that many other European and American nations were induced to organize similar enterprises. Great expositions of more or less importance to the industrial arts were held prior to 1850 at Berlin, Vienna, Saint Petersburg, Brussels, Moscow, Stockholm, Dublin, Lisbon, Madrid, Manchester, Philadelphia, New York, and other great centers of population. Among the noteworthy international expositions held since are several that attracted the attention of practically every civilized nation. The first British exhibition of an international character was held at Crystal Palace, London, in 1851. Soon after, in 1853, the United States made its first general effort in this direction at New York. The first universal French exposition was opened in Paris in the Champs Elysées in 1855 and contained exhibits of about 24,000 different persons and interests. A great international expositon was given in Haarlem, Holland, in 1861. The Belgians opened a similar enterprise at Brussels in the same year, and Great Britain followed with an international exhibition in 1862.

The second international exposition of France opened on the Champ de Mars in 1867. It was followed by the exposition at Philadelphia, Pa., in 1876, to commemorate the centennial of the Declaration of Independence. The main building of the Centennial Exposition alone had a floor space of twenty acres, being 460 feet wide and 1,180 long, while the other buildings were proportionally grand and extensive. France held a third international exposition at Paris in 1878, the area of its site being 140 acres, and in 1889 gave the fourth to commemorate the centenary of the French Revolution. One of the prominent features of this exposition was the famous Eiffel Tower (q. v.). The next great exposition was held at Chicago, Ill., in 1893, being designed to commemorate the 400th anniversary of the discovery of America. In many respects it may be said to have been the most successful and popular display ever made in the Western Hemisphere. However, it was closely rivaled by the Louisiana Purchase Exposition held at Saint Louis, Mo., in 1904, to commemorate the Louisiana Purchase. Both before and since the Chicago exposition numerous national or district expositions have been given, such as the Cotton States Exposition at Atlanta, Ga., the Trans-Mississippi at Omaha, Neb., the Pan-American at Buffalo, N. Y., the Alaska-Yukon Pacific at Seattle, Wash., and the Panama-Pacific-International Exposition at San Francisco, Cal., in 1915. The Sesquicentennial Exposition was held at Philadelphia, Pa., in 1926 to celebrate the signing of the Declaration of Independence and was an international event.

The leading expositions of the last thirty years, with the total paid and free attendance and the total receipts, including admissions and concessions, are as follows:

Expositions.	Attendance.	Receipts.
Vienna, 1872	7,254,687	$ 6,917,832
Philadelphia, 1876	9,910,996	3,813,724
Paris, 1878	16,032,725	2,531,650
Paris, 1889	28,149,353	8,300,000
Chicago, 1893	27,539,521	14,117,332
Paris, 1900	50,120,540	24,788,360
St. Louis, 1904	18,741,073	10,162,380

See World's Columbian Exposition.

EX POST FACTO (ĕks' pōst făk'tō), a law which is retroactive and makes an act criminal that was not criminal when committed, or increases the severity of the punishment attached to the crime when it was committed. The United States and the several states are forbidden by the Constitution to pass such a law.

EXPRESS (ĕks-prĕs'), a system of rapid conveyance and safe delivery of merchandise and parcels. The express business of the United States is the outgrowth of the custom under which stage-coach drivers, railroad conductors, and others were intrusted with parcels for delivery, and was formally organized by William F. Harnden (1813-1845), of Boston, in 1839. He contracted with the Boston and Worcester Railroad Company for the transmission of packages. The project commended itself to business men, and soon after express lines were organized and connections established in all directions. In 1849 the Adams & Company's California Express was established; in 1852, the Wells, Fargo & Company's; and in 1855, the American-European Company's. The express business is carried on by the express companies under contract with the railroad companies. In 1917, as a direct result of the war, the various American lines were consolidated into the American Railway Express.

At present the capital stock of the express companies amounts to millions of dollars, the leading organizations being the American Railway Express Company, the Southeastern Express Company, and a number of connecting lines. The American lines have direct connections with responsible express companies in Canada, Newfoundland, and the leading countries of the world. Among the leading companies of Canada are the Dominion Express Company, the Canadian National Express Company, and the British American Express Co. The business comprises, besides delivering parcels of merchandise, the issuance of checks, collection of accounts, and in some cases the care of deposits. A system of C. O. D. business, meaning *collect on delivery*, comprises the plan of transporting goods to consumers or dealers and collecting the purchase price when delivered.

In most European countries the carrying serv-

ice is performed by the post office system under the direction of the government, though in Great Britain the railroad companies themselves handle this branch of business on all lines where the parcel post has not been established. The law includes express companies with the list of common carriers, by which they are held liable for losses the same as such carriers, even though their bills of lading declare otherwise. Express money orders are receivable at banks, and payable in nearly all civilized countries. The United States government took charge of the express business in 1917 as a war measure.

EXTENSION (ĕks-tĕn'shŭn), in physics, that property by virtue of which matter occupies space and possesses volume. An atom is exceedingly small, yet it has definite size; that is, it has extension, or occupies space in three dimensions—length, breadth, and thickness. Extension is necessarily possessed by molecules and masses and is, therefore, a general property of matter.

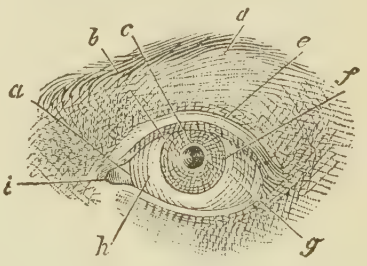
EXTRACT (ĕks'trăkt), in pharmacy, the products obtained by evaporating solutions that contain medical principles. The substances are chiefly of vegetable origin and yield solids and liquids, the former being known as *extracts* and the latter as *fluid extracts*. Solid extracts are obtained by digesting vegetable substances with water, alcohol, ether, or acetic acid, and evaporating the products until they are reduced to a pasty or dry consistence. Liquid extracts are made by crushing the plants to obtain the juices, which are heated and evaporated. Various methods are employed, the process depending upon the kind of extract to be obtained. In some cases the juices are allowed to stand a brief time after the masceration, when they are carefully filtered, and then are evaporated or distilled a number of times to obtain the strength required.

EXTRADITION (ĕks-trà-dĭsh'ŭn), the right to demand the delivery of a fugitive from justice from one state or nation to another. In the absence of treaties it is not the duty of a nation to turn over a fugitive criminal to the state from which he has fled, a position maintained both in England and the United States, hence extradition between nations is based upon treaties. However, extradition between the states or provinces of a particular country is usually regulated by the constitutional or national law. This is provided for by the Constitution of the United States, which requires that "a person charged in any State with treason, felony, or other crime who shall flee from justice and be found in another State, shall, on demand of the executive authority of the State from which he fled, be delivered up to and be removed to the State having jurisdiction of the crime."

The Jay Treaty of 1794 was the first treaty of the United States to provide for extradition, but it was not carried into effect by an act of Congress. The Treaty of 1842 was the first to provide for extradition between Great Britain and the United States. It is the general rule that a criminal who has been extradited for a particular offense cannot be tried on another charge. This question arose in 1875, when the United States procured the extradition of a criminal who had committed an offense not mentioned in the treaty, being extradited on one and then tried on another, and against this Great Britain protested. Extradition treaties are in force among all the leading nations.

EYCK (īk), **Hubert** and **Jan van**, two Flemish painters of the 15th century. The date and place of their birth are uncertain, though it is thought they were born at Maas Eyck and that they resided chiefly at Bruges and Ghent. The date of Hubert's birth is about 1366. His death occurred in Ghent, Sept. 18, 1426. Jan was born about 1389 and died in Bruges, July 9, 1440. These two painters are distinguished largely because they are the reputed inventors of oil painting and the founders of a Flemish school. The exquisite finish and beautiful coloring of their work have never been excelled. Many of the masterpieces executed by the two brothers are extant, the best being found in Bruges, Berlin, Antwerp, Ghent, Paris, and Munich. Three pictures painted by Jan in the years 1432, 1433, and 1434 are in the national gallery in London. The exquisitely finished production, "Chancellor Rollin Kneeling Before the Virgin," is in the Louvre, in Paris.

EYE, the organ of sight, consisting of a globe about an inch in diameter, situated in a bony cavity of the skull, and protected by the



THE HUMAN EYE.

A, semilunar fold; *B*, iris; *C*, pupil; *D*, eye-brow; *E*, eyelid; *F*, cornea; *H*, sclerotic coat.

overhanging brow. It is formed of a tough membrane called the *sclerotic* coat, which gives form to the eye, the transparent, convex part in front forming the *cornea*. A thin, black membrane, termed the *choroid* coat, lines the sclerotic coat, which contains the blood vessels, while its black color serves to prevent the reflection of the rays of light. A very thin and transparent membrane, called the *retina*, is inside the choroid coat and is an expansion of the optic nerve. The anterior and posterior chambers are filled with a liquid, that in the former being a thin, clear liquid called the

aqueous humor, and that in the latter a thick, jellylike fluid termed the *vitreous humor.* These humors serve to keep the eye distended and in shape. Between the two chambers is the *crystalline* lens, which operates to bring the rays of light to a focus on the retina and is kept in place by the *ciliary* process. A curtain, called the *iris,* is hung behind the cornea, whose center is a hole called the *pupil.* The several colors observed in the eyes of different persons are merely the iris, which varies from blue to a dark brown and is seen through the pupil. The colorless effect seen in the eyes of the albino is due to the absence of color cells; the pink tint often seen in them is caused by the blood affecting the appearance of the iris on account of the absence of other coloring matter.

The eye is protected by close-fitting shutters called *eyelids,* and by a padding of fat situated between the eyeball and the walls of the orbit in which it is situated. A mucous membrane lines the inner side of the eyelids, and, by being exceedingly sensitive, aids in protecting the eye from irritating substances. The edges of the lids are lubricated by oil glands situated within the *eyelashes,* which prevent them from adhering to each other. Besides, the lashes guard against dust, while, with the lids, they serve to shield against a blinding light. The mucous membrane and cornea are moistened by a saltish fluid called *tears,* which is secreted by the *lachrymal glands,* two oblong bodies situated immediately above and to the outside of the eyeballs. Several ducts facilitate a flow of tears upon the inner surface at the outer edge of the upper eyelid, thus washing the eye and keeping it clean from dust, the tears passing into a little basin at the inner part of the eye near the nose, called the *lachrymal lake,* from which they are drained into the nose by the *nasal duct.* The lachrymal lake overflows upon the face in disease, old age, and when crying.

The phenomenon of sight is one of intense interest to the student of natural history. It is dependent upon a substance called *ether,* which is infinitely more subtile than air and is thought to be a thin gas filling all space. Waves of light are produced in the ether as sound waves are caused in the atmosphere. The motion waves of ether are produced by a light, for example a lamplight, pass through the pupil of the eye to the retina, and are carried by the rods and cones through the *optic nerve* to the brain, where the light is seen. The variously shaped rods and cones serving to carry the light are to the eye what bristles, otoliths, and Cortian fibers are to the ear. The optic nerve, which has its root in the brain and enters the eyeball, is itself insensible to light. There are no rods and cones at the point where it enters the eye and this is called the *blind spot.* The rays of light are bent by the convex lens so they meet at a point called the *focus;* a good example of this can be given by the use of a common burning glass, through which the focus point is heated to burning by bending the rays of the sun. When entering the eye, the rays of light are converged similarly by being brought to a focus on the retina, and are influenced somewhat in a like manner by the cornea and the humors of the eye.

Distant objects tend to diverge rays of light less than those near by, and under such conditions the crystalline lens does not need to bend so much as in seeing objects near at hand. This property of adjusting the lens of the eye to far or near vision is called *accommodation.* The ordinary adjustment of the eye muscles when at perfect rest is of such a character that objects at all distances over twenty feet can be seen clearly. Objects at a smaller distance than twenty feet away from the eye require that the muscles adjust the lens to a more curved position. In this way it is possible for the eye to see clearly at a distance

AN OPTICAL ILLUSION.

of about five inches, while vision is best at about ten inches from the eye.

The field of view in which a person can clearly recognize objects is confined to a small space immediately in front of the eye, while only indistinct shadows seem to occupy the remainder of space near at hand. In reading not more than two or three words can be seen distinctly, but by rapid and unconscious movements of the eyes sidewise the field of view is greatly enlarged. When the eyes are directed toward an object, the sensation of sight is produced almost instantly, but the image persists about one-tenth of a second. It is due to this property that a lighted stick waved rapidly by the hands appears as a circle of fire. Exhibitors take advantage of it by throwing a succession of pictures of a moving object upon a screen at a particular rate, and thus convey to the auditors the effects of movement without interruption. If two shining lights are waved,

they appear as one, and two colors revolved quickly give the effect of a mixture of two. Thus, a yellow and a blue surface placed side by side and revolved quickly before the eye appear as a single green spot. The eye is subject to many illusions, which is taken advantage of by exhibitors and in the manufacture of many toys and fireworks. The vertical lines in the illustration are perfectly parallel, but the diagonal hatching, as the result of contrast, cause them to appear tapering in alternate directions.

Color-blindness is due to an impairment of the nerves of the retina, leading to an inability to recognize certain colors. Since locomotive engineers and sailors are guided by differently colored signals, this defect is a serious one. The retina becomes exhausted when the eye looks steadily at an object for a long time. It is fatigued by bright-colored objects much more readily than others, and during a state of exhaustion is often confused in the recognition of colors, being made color-blind. The intensity of light has an effect upon the pupil, bright light causing a contraction. This results from a strong light exciting the reflex centers of the optic tubercles and has the effect of contracting the muscles of the iris. In the dark, on the other hand, the pupil is enlarged so as to admit all the light possible. In this way, and by means of the muscles that control the upper and lower lids and the eyebrows, it is possible for the eyes to protect themselves against a light too strong to be admitted, though the contracted muscles become easily tired and pain results. *Far-* and *nearsightedness* are caused by defects in the crystalline lens. If the lens is too convex, the rays are brought to a focus before they reach the retina; if too flat, the retina is reached before coming to a focus. In each case the sight is more or less indistinct. Another common defect is a flattened or elongated shape of the globe of the eye. Farsightedness results when the globe is flattened and nearsightedness when it is elongated. The former is overcome by convex and the latter by concave lenses.

The care of the eyes is an important matter, since the loss of vision is a source of much sorrow. Glasses should be worn when they serve to improve the sight, since straining impaired power results in even greater weakness. Fine print and reading by a dim light are harmful, while the sight is often impaired by reading on cars, for the reason that the lens becomes wearied by striving to adapt itself to continuous variations of distance. Light should never be in front when reading or working, but should come over the left shoulder. Alcohol and tobacco tend to cause dimness of vision by weakening the optic nerve. Röentgen (q. v.) discovered a kind of light produced by electricity, in 1895, which penetrates flesh, wood, and other substances. By means of this light it is possible to determine by sight the forms of different organs of the body, to examine the bones in the living body, and to locate many substances foreign to the system. Several valuable discoveries relative to the eye have been made by means of it.

The eyes of fishes, reptiles, birds, and quadrupeds are essentially the same as in man. In insects the eyes are immovable and have a dome shape. Thousands of smaller eyes like honeycomb make up each of the two eyes. At the bottom of the cavity is a nerve to which each little eye may conduct light by means of a lens. As the scale of animal life descends, there is a marked decrease in the power of vision. For instance, in the leech the nerves of sight end in a spot of dark coloring matter of the skin by means of which it is able to receive some idea of its surroundings. Still lower in the scale we find life forms that are barely able to recognize the difference between light and darkness, while those that live wholly in the dark lose the use of this organ, as, for instance, the fish found in the Mammoth Cave of Kentucky.

EYELIDS. See **Eye; Lachrymal Glands.**

EYLAU (ī'lou), a town in Germany, 22 miles south of Königsberg, on the Pasmar River. It was the scene of an indecisive battle on Feb. 8, 1807, between Napoleon and the allied forces of the Prussians and Russians under Count Levin Bennigsen (1745-1826). The army under Napoleon consisted of about 80,000 men, while the allied forces were smaller, but the latter possessed more artillery. A brisk struggle continued during the day, and as night approached the troops of Napoleon were driven before the allies. In the night the French army retreated. The loss on each side is estimated at about 18,000 men. The town has a population of 3,600 and is connected by railway with Königsberg.

EYRE (âr), one of the largest lakes in Australia, in the State of South Australia, at an altitude of 80 feet. It has an area of 3,708 square miles. Its name is from Edward John Eyre, who discovered it in 1840. The water is highly salty and in dry seasons evaporates largely, leaving a great salt marsh. The waters of the Macumba, Cooper, and Warburton rivers flow into it, but it has no outlet to the sea. A railway extends from Lake Eyre to Spencer Gulf.

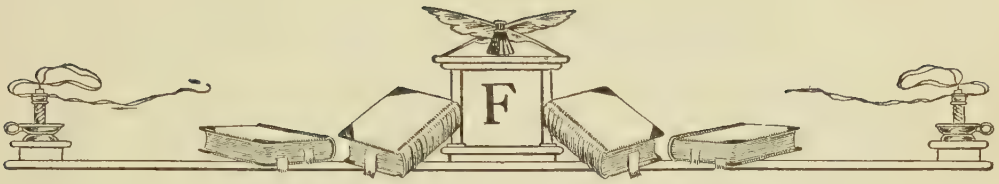
EYRE, Edward John, explorer, born in Yorkshire, England, in 1815; died Nov. 30, 1901. He emigrated to Australia in 1833, where he explored the south coast and in 1840 discovered Lake Torrens. Subsequently he was Lieutenant Governor of New Zealand and later held a similar position in Jamaica, where he suppressed a negro insurrection with much severity. He returned to England in 1866, where he was prosecuted for murder by a committee of which John Stuart Mill was a member, but

was eventually justified for his course of executing the leader of the insurrection.

EZEKIEL (ĕ-zē'kĭ-el), meaning strength of God, the third of the four greater prophets of Israel, to whom is attributed one of the books of the Old Testament. He was the son of Buzi, a priest, and was carried captive to Mesopotamia along with Jehoiachin, King of Judah, about eleven years before the destruction of Jerusalem under Zedekiah. There with other Jews he settled on the banks of the Chebar River and began his work as a prophet in 594 B. C. His prophecies are mostly in chonological order and consist of three parts—those relating to the complete overthrow of the Jewish nation on account of increasing unfaithfulness to God, those threatening the surrounding nations with divine punishment, and those pertaining to the future deliverance of the Hebrew nation and the rebuilding of Jerusalem. Ezekiel's death is not recorded, but it is thought his prophetic career extended over a period of 22 years.

EZEKIEL, Moses Jacob, sculptor, born in Richmond, Va., Oct. 28, 1844; died March 27, 1917. He attended the public schools, served during the Civil War in the Confederate army, and in 1869 went to Europe to complete his higher education. At the Academy of Art in Berlin he studied sculpture, and later established a studio at the Baths of Diocletian in Rome. His works have been exhibited in Cincinnati and New York City, and in the art galleries of Berlin and Rome. His "Religious Liberty" is a group modeled for the Jewish Order of the Foreign Covenant and is now in Fairmount Park, Philadelphia. He designed and completed the Jefferson monument in Louisville, Ky. Later he prepared eleven statues of famous artists for the Corcoran Gallery in Washington, and made relief portraits of Longfellow, Liszt, Hohenlohe, Lee, and Farragut. Other works completed by him are "Judith," "Man and Cupid," "Eve Hearing the Voice," "Apollo and Mercury," and "The Daughters of Eve."

EZRA (ĕz'rà), Jewish priest, a descendant of Aaron, whose patriotic and priestly services to the Jews are detailed in the book bearing his name. He was a ready scribe in the law of Moses, to which he was passionately attached. An exile in Persia, he so commended himself to the reigning monarch, Artaxerxes, as to obtain from him permission to lead the second expedition of the Jews back to their own land This enterprise began about 458 B. C. Subsequently he resided in Babylonia and still later at Jerusalem, where he endeavored to reimpose more strictly the laws of Moses, forbidding marriages with heathen women and annulling such ties where they had been formed. He introduced into the Jewish literature the square Chaldee characters, in place of the old Hebrew forms that had been customary until then. The place of his death is uncertain. The *Book of Ezra* spans a period of eighty years, from Cyrus in 536 B. C. to Artaxerxes in 456 B. C. Some biblical scholars believe it to be from the pen of Ezra, while others admit a plurality of authors. Both Jews and Christians consider the work part of the Scripture canon.



F, the sixth letter and fourth consonant of the Latin and English alphabets. It is formed by the passage of breath between the upper front teeth and the lower lip, is classed with V as a labio-dental, and belongs to the class of consonants called *aspirates*. The figure of F corresponds to the *digamma* of the Greek and resembles it closely in power. F, in music, is the fourth note of the natural diatonic scale of C. F major, as a key, has one flat at its signature, namely, B flat. The tone F is called *fä* in Italy, France, and some other countries.

FABER (fā'bĕr), **Cecilia Bohl von.** See **Caballero, Fernan.**

FABER (fä'bĕr), **Johann Lothar,** born at Stein, Germany, June 12, 1817; died in 1896. He inherited from his father a small factory at Stein, which he enlarged and gave to it an international reputation for the manufacture of lead pencils. Later he established offices in Berlin, London, Paris, and New York. He founded extensive mills at Cedar Keys, Fla., where he obtained large quantities of cedar wood for exportation and use in his enterprises. Afterward he enlarged his manufactory by adding to the list of products all sorts of materials for drawing, painting, and writing. A patent of nobility was conferred upon him in 1863 and later he became a counselor of state. A large portion of his fortune was devoted to the establishment of schools and charitable institutions.

FABIUS MAXIMUS (fā'bĭ-ŭs măx'ĭ-mŭs), a distinguished member of an illustrious patrician family of Rome. The Fabii family established a foothold by undertaking to defend its territory against the Veientes, with whom they had been at war, but in 477 B. C. they were all killed, except one member who had remained at Rome. Through this survivor the family was perpetuated. Fabius Maximus was the most distinguished of the second Fabi family. He served five times as consul and twice as censor, and, after the Roman defeat at Trasimenus, was elected dictator. In the second Punic War he attained eminent success against Hannibal by the Fabian policy of war. This policy consisted of avoiding a direct engagement, harassing the enemy by surprises, annoying them by marches and flank movements, and destroying their foragers and stragglers. While he pursued this policy, Rome assembled her forces and prepared them for greater efficiency in common defense against the enemy. In the fifth consulship Fabius recovered Tarentum, an important position that had long been possessed by Hannibal. His death occurred in 203 B. C.

FABLE (fā'b'l), a feigned story or tale intended to enforce some moral precept. In modern literature the fable is confined to short stories, either in prose or poetry, in which inanimate things and animals are represented with human interests and passions. By the novelty and utter impossibility of the representation, the interest of the hearer or reader is excited, and thus its symbolic meaning and moral become apparent to him, at least if the fable is well contrived. The ancient fabulists were simple, clear, and earnest, and seem to have sprung up in the East. Among the more celebrated are Bidpai, or Pilpai, and the Arabian Lokman, who lived at the time of King David. Among the Greeks the greatest fabulist is Aesop. Phaedrus, the most celebrated Roman fabulist, cleverly imitated Aesop, but with considerable modification, thus giving force to his writings. In later times Gay among the English, Lessing and Gellert among the Germans, and Krylov among the Russians are celebrated. La Fontaine, a French writer of fable, for delicate sarcasm, sagacity, and felicity of expression takes high rank.

FABRICIUS (fà-brĭsh'ĭ-ŭs), **Caius,** an ancient Roman who was noted for his characteristic virtue in moderation, fearless integrity, and contempt of riches. He was elected consul in 283 B. C., defeated the Boii and the Etruscans the same year, and was sent on a mission to treat with Pyrrhus the following year. Notwithstanding the fact that he held numerous lucrative offices, he died poor, and the state provided funds for the support of his daughter. In recognition of his military achievements and incorruptible integrity, a decree was made by the senate which provided a burial place within the city for him and his descendants.

FABRICIUS (fà-brē'sē-ŏŏs), **Johan Christian,** entomologist, born in Tondern, Germany,

Jan. 7, 1745; died in Kiel, March 3, 1808. He was educated at Copenhagen, Leyden, and Freiberg, and obtained a professorship in the University of Kiel. Besides his excellent service in teaching natural history, he wrote a number of treatises on entomology and outlined a policy of economy for Denmark. Among his publications are "System of Entomology," "Philosophical Botany," and "Philosophical Entomology."

FAÇADE (fȧ-sȧd'), the exterior face or front of a building. This term is applied chiefly to classic architecture and buildings of some magnitude. The façade contains the principal entrance. The term is used with a qualifying adjective when it refers to other faces of a building, as *court façade, rear façade,* and *lateral façade.* Many mediaeval churches have *false façades,* which are different in outline than the buildings themselves.

FACE, the front part of the human head, extending from the chin to the line of the hair on the forehead. It includes the nose, eyes, chin, mouth, cheeks, and forehead. The bony foundation is composed of fourteen bones, twelve of which occur in pairs. The single bones are the *vomer,* which separates the nostrils, and the bone of the lower jaw, or *inferior maxillary,* which is the only one that is movable. The *superior maxillary,* or upper jaw bone, contains the upper teeth. Two *malar* bones form the cheeks; two *palate* bones, the palate; and two *turbinated* bones, the outer walls of the nostrils. Between the eye socket and the nose are two *lachrymal* bones. The bridge of the nose is formed by two *nasal* bones. All of the bones of the face are irregular in form. Beneath the *frontal* bones, which belong to the cranium, are two deep quadrangular cavities, called the *orbis,* which contain the eyeballs, the tear apparatus, and the protective organs of the eye. In the depressions and small cavities are located glands, nerves, and blood vessels. Projecting jaws and a receding forehead are prominent features in the face of brutes.

FACIAL ANGLE (fā'shạl ăn'g'l), an angle formed by two imaginary lines—one drawn

FACIAL ANGLES.

from the most prominent part of the forehead to a point opposite the incisor teeth; the other from the external ear to the same point, the object being to measure the elevation of the forehead. This angle was made the basis for classifying the races by the Dutch anatomist, Pieter Camper, and is sometimes called *Camper's Angle.* While it has served a useful purpose in ethnology, it is not an infallible criterion of the intellectual capacity of an individual. The general facial angle of anthropoid apes is 40°, of the African Negro 70°, and of the Europeans 80°. Since angles almost as varied can be found in a single large community, the Camper method has been superseded by those of Blumenbach, Cuvier, etc.

FACTORY (făk'tō-rỹ), a name derived from the word *factor,* which, in Great Britain, has reference to an agent who sells goods for another. In America it is more common to call such an agent a commission merchant, since his compensation is based on a commission or a percentage upon the goods he buys or sells. On the other hand, the word *factory* has reference to the place or house where such agents transact business.

Within recent years the term factory has come to be applied to an establishment devoted to the manufacture of various articles of commerce. In this sense it includes the machinery and buildings necessary to such manufacture. The establishment of great factories is comparatively recent and resulted from the invention of useful machinery, the extensive subdivision of labor, and the construction of vast avenues of commerce that facilitate the transportation of manufactured commodities to distant consumers. Doubtless material advantages have sprung up from the factory system. They include the increased productiveness resulting from the division of labor; greater mechanical accuracy and a lessening of the cost of production, two results of bringing together different laborers with varied capacity; and the wholesome effects that follow coöperation and copartnership among the masses of the workingmen. Trades unions and the various forms of organization that have sprung into existence are the direct result of the concentration of laborers in manufacturing centers.

It is probable that the good which springs from the factory system is counterbalanced to a large extent by the curtailment of independent intelligence, which follows the minutely subdivided operations resulting from the piecework of each individual workman. Other disadvantages urged against the factory system are the evil influences upon the health of the workmen, brought about by being crowded into small rooms; the contract system, by which large colonies of foreign laborers are imported; and a reduction of wages as a natural consequence of employing many children and women.

The factory system as now found in America, both in Canada and the United States, has made it necessary to regulate by law the manner of managing workshops, mines, and factories. Legislation along this line has been intended to improve the sanitary conditions of all places where large numbers of workmen are employed

by making them subject to public inspection, and establishing rigid rules under which vast enterprises may be managed efficiently. Among the primary objects of legislation are the protection of life and health of the workmen, prevention against spreading infectious diseases and vermin by reason of the manufactured product, and protection of the laborers and operators against strikes, disorders, and general disorganization of institutions. Legislation has been directed more commonly with respect to the number of hours the workmen may be employed daily and the improvement of the conditions of factory work. Other objects have been to limit the labor of women and minors and to regulate the manner of and time for which laborers shall receive compensation.

Statutory provisions in some cases forbid the employment of minors under certain ages, while in others it is necessary for children to be able to read and write, or to have attended school for a certain period, before being admitted to the factory. These safeguards are intended to prevent the corruption of morals among children and vouchsafe to them conditions under which they may secure a suitable education. The supreme courts in a number of states, among them Ohio, Pennsylvania, Missouri, West Virginia, and Illinois, have decided that laws which require the payment of laborers in money are unconstitutional, though others have held them sound and operative. Among the many questions of general concern, in which a large number of people are interested, those relating to the rights and privileges of both the employer and employee take high rank. However, the legislation which may tend to secure the best business conditions, which will operate to the highest interest of both the capital and labor employed in the factory system, is yet awaiting solution by statesmen and legislators.

FACULTY (făk'ŭl-tў), the term employed to designate collectively the teachers and professors of an institute, college, or university, or the instructors in any department of such an institution, as the faculty of law, of theology, of arts, or of medicine. It is applied collectively to the members of the learned professions, as the faculty of advocates, the medical faculty.

FACULTY, in mental science, a natural power of the mind by which it acts uniformly and with facility in some specific way. Hewett defines faculty as a power under the control of the will, having a specific work to do, and as examples enumerates memory, seeing, love, and judgment. Crabb holds that faculty is a power derived from nature, and differs from ability in that the latter is derived either from circumstances or otherwise.

FAED (fād), **Thomas,** noted painter, born in Burley Mills, Scotland, June 8, 1826; died Aug. 17, 1900. He became an associate of the Royal Scottish Academy in 1849, a member of the Royal Academy in 1861, and an honorary member of the Vienna Royal Academy in 1875. Among his earliest drawings in water colors is one entitled "Old English Baron." The most celebrated of his newer works are "Mitherless Bairn," "The First Break in the Family," "From Dawn to Sunset," "Reading the Bible," "The Last of the Clan," and "Scott and His Friend at Abbotsford."

FAHRENHEIT (fä'ren-hīt), **Gabriel Daniel,** eminent physicist, born in Dantzic, Germany, May 14, 1686; died Sept. 16, 1736. He studied for commercial business, but soon abandoned his early desires and entered upon the study of natural philosophy. Soon after he traveled extensively and later settled in Holland, where he took a course under Gravesande in science and formed the friendship of many noted men. In 1714 he discovered that quicksilver possesses greater utility for use in construction of thermometers than spirits of wine, which had been employed previously. In devising a thermometric scale he took as the *zero point* the lowest temperature observed by him in the winter of 1709 at Dantzic, which he found was produced by an equal quantity of snow and salt. The space between this point and that to which the mercury rose at the freezing point of water is divided into 32°, and from zero to the boiling point of water into 212°. Later he contrived a machine for draining swamp lands. In 1724 the Royal Society of London elected him a fellow. The Fahrenheit thermometer is generally used in the United States for all practical purposes. See **Thermometer.**

FAÏENCE (fä-ē-äns'), a term applied generally to all classes of porcelain and glazed earthenware. The name was derived from the town of Faenza, Italy, where *majolica,* a fine grade of pottery, was manufactured in the 14th century. The faïence manufactured at present was invented in the 16th century as an imitation of majolica and obtained its name in France. However, the faïence of the market is made of a ruddy earth, covered with an enamel, and is frequently painted in rich colors.

FAINTING (fānt'ĭng), or **Syncope,** a sudden loss of consciousness, with pallor and feeble respiration and heart action. The morbid condition generally continues from a few seconds to a minute, but in some cases lasts for hours and even days. It is produced by loss or sight of blood, pain, or impure air generated in overcrowded public buildings. Fright and sudden joy or grief may cause fainting in some persons. It rarely ends in death and more commonly affects women than men. Recovery is most rapid when the body is in a recumbent position. Fresh, cool air, cold water sprinkled on the face, and the loosening of any tight articles of dress contribute to a speedy close of the syncope.

FAIR, a stated or regular market where buyers and sellers gather to transact either a par-

ticular or general class of business. Fairs of this character originated on account of the convenience resulting from the buyers and sellers of agricultural products common to a region coming together. The fairs held in the Middle Ages were chartered by public officials, who announced them by proclamation. This class never obtained a wide foothold in America, though there are fairs at which an exhibit of agricultural products, manufactures, and other articles of value are exhibited for public inspection and study. The term is applied in a general sense to bazaars where fancy articles are offered for sale either at special times or permanently, and to the agricultural and industrial exhibitions held under the direction of counties, states, or nations. In Europe it is quite common to hold fairs at which buyers and sellers are brought together. Among the great periodical fairs are those held at Novgorod, Russia; Lyons, France; Leipzig and Frankfort-on-Main, Germany; the Donnybrook Fair, Ireland; the Glasgow Fair, Scotland; and the Greenwich Fair, England.

FAIRBAIRN (fâr'bârn), **Sir Andrew,** railroad magnate, born in Glasgow, Scotland, March 7, 1828. He descended from a prominent family, was educated at Cambridge University, and was soon after called to the bar. In 1856 he formed a partnership with his father, Sir Peter Fairbairn, a manufacturer of tools and implements. In 1866-68 he served as mayor of Leeds, was knighted soon after, and became interested in the Great Northern Railway. He served as commissioner at the Paris exposition in 1878, and was a member of the House of Commons for twelve years, beginning in 1880. Fairbairn was prominently connected with several international railway congresses of Europe. The King of Belgium knighted him, and in 1892-93 he served as high sheriff of Yorkshire.

FAIRBAIRN, Andrew Martin, theologian, born in Edinburgh, Scotland, Nov. 4, 1838; died Feb. 9, 1912. He was educated at Edinburgh, Glasgow, and Berlin, and in 1861 began his ministry at Bathgate, Scotland. In 1878 he was made lecturer in the University of Edinburgh, became chairman of the Congressional Union of England and Wales in 1883, and was chosen principal of Mansfield College, Oxford, in 1886. In 1890 he visited the United States and subsequently lectured at a number of leading educational institutions of America. His publications include "Studies in the Life of Christ," "The Place of Christ in Modern Theology," "Catholicism, Roman and Anglican," and "The Philosophy of the Christian Religion."

FAIRBAIRN, Sir William, civil engineer, born in Kelso, Scotland, Feb. 19, 1789; died April 18, 1874. After securing a rudimentary education, he was apprenticed as an engine-wright in North Shields, and soon after commenced business at Manchester, where he made several important inventions that led to the use of iron shafting in cotton mills. His attention became attracted to the use of iron as a material in bridge and ship building about 1831, which enabled him to obtain many patents on practical inventions, and was the immediate cause that led to the construction of several thousand bridges. Later he became extensively interested in iron shipbuilding at Manchester and Millwall, near London, and produced many useful and serviceable vessels. He was made a baronet in 1869 and later a chevalier of the Legion of Honor. In connection with Robert Stephenson he constructed a tubular bridge across the Menai Strait. Among numerous works and papers published by him are "Our Canal Steam Navigation," "Iron and Great Britain," "A Treatise on Mills and Mill Work," and "The Strength of Iron at Different Temperatures."

FAIRBANKS, Charles Warren, statesman, born on a farm near Unionville Center, Ohio, May 11, 1852. He graduated at the Ohio Wesleyan University, was admitted to the bar in 1874, and established a successful practice at Indianapolis. In 1897 he was elected United States Senator as a Republican, and the following year served as a member of the British-American joint high commission. He was reëlected to the United States Senate in 1903, and the following year became Vice President of the United States, serving until 1909. In 1916 he was defeated for Vice President. He died June 4, 1918.

CHARLES W. FAIRBANKS.

FAIRBANKS, Erastus, manufacturer, born in Brimfield, Mass., Oct. 28, 1792; died Nov. 24, 1864. He entered upon the study of law, but soon began the manufacture of cast-iron plows and castings. In 1824 he located a plow factory at Saint Johnsbury, Vt., but later gave his entire attention to the manufacture of platform scales invented by his brother, Thaddeus Fairbanks (1796-1886), who was jointly interested in the enterprise. Erastus was a member of the State Legislature in 1836-38, became president of the Passumpsic Railroad Company in 1849, and was elected Governor of Vermont in 1851, and again in 1860. The scales manufactured by the firm, though modified by improvements, are in general use throughout the United States. His brother, Thaddeus, was born Jan. 17, 1796; died April 12, 1886. He worked in a saw and grist mill with his father and patented the well-known Fairbanks plat-

form scales in 1831. The patents held by him covered about fifty useful inventions. He was granted the cross of the Order of Francis Joseph by the Emperor of Austria in 1873.

FAIRBURY, county seat of Jefferson County, Nebraska, 56 miles southwest of Lincoln, on the Chicago, Burlington and Quincy, and other railways. Water power is derived from the Little Blue River. It has manufactures of flour, castings, and machinery. The features include the high school, courthouse, city hall, public library, and federal building. It was settled in 1869 and incorporated in 1886. Population, 1920, 5,454.

FAIRCHILD, James Harris, theologian, born in Stockbridge, Mass., Nov. 25, 1817; died there March 19, 1902. In 1838 he graduated at Oberlin College, where he became professor of languages in 1842. He was elected president of the institution in 1866. In 1870-71 he traveled in Eurasia and Africa, and subsequently in the Hawaiian Islands. Among his works are "Elements of Theology" and "Moral Philosophy."

FAIRCHILD, Lucius, soldier, born at Franklin Mills, Ohio, Dec. 27, 1831; died May 23, 1896. At the second battle of Bull Run he had command of the famous "Iron Brigade," and later fought at Antietam and Gettysburg, losing an arm at the latter engagement. In 1863 he was commissioned brigadier general, served three terms as Governor of Wisconsin, and in 1872 was appointed consul at Liverpool. He was commander in chief of the Grand Army of the Republic in 1886.

FAIRFAX (fâr'făks), **Thomas, Lord,** distinguished general, born in Denton, England, Jan. 17, 1612; died near York, Nov. 12, 1671. He studied at Cambridge, and soon after entered the military service in Holland. In 1644 he distinguished himself in the Battle of Marston Moor, and the following year received a command in the parliamentary forces. He refused to march against the Scots in 1650 and the command was given to Cromwell. After retiring to private life in 1660, he received an appointment as commissioner to The Hague to negotiate the return of Charles II. to England. He published several works in prose and poetry, the one entitled "Short Memorial" being the best known.

FAIRFIELD, a city of Iowa, county seat of Jefferson County, 48 miles northwest of Burlington, on the Chicago, Burlington and Quincy and the Chicago, Rock Island and Pacific railroads. It has a fine county courthouse and is the seat of Parsons College. The manufactures include wagons, ironware, machinery, tile, and farming implements. It has electric lights, waterworks, and a considerable trade in produce and merchandise. The first settlement in the vicinity was made in 1839 and it was incorporated in 1847. Population, 1925, 6,333.

FAIRHAVEN. See **Bellingham.**

FAIRIES (fâr'ĭz), the name applied to imaginary beings, ordinarily small and of graceful human form, but capable of assuming any shape and working good or evil to mankind. A belief in fairies has been among the superstitions of many peoples. Some other names for these imaginary creatures are *elves, brownies, goblins, dwarfs, pixies, kelpies,* and *gnomes.* It is difficult to give any scientific definition of the nature of fairy superstitions, because they followed no regular law, human or divine, but obeyed the impulse of their own caprice. Hence, every fairy tale differs from others in some respects. In the parts of the world where there are mountains, mists, cataracts, and stormy oceans all superstitions are naturally exaggerated, while in flat and well-cultivated countries the fairies are simple and homely, and connect themselves with matters of domestic routine, such as sweeping the floor, skimming milk, preserving butter, and other household duties. In Scandinavian countries the fairy people are connected with storms and convulsions. They are represented in the act of betraying people into dangerous places, flying away with them into cloudland, or as leading them through endless caverns within the earth. They have been spoken of in Ireland as a wandering remnant of fallen angels.

The tales of some nations divide fairies into three classes—those that dwell in the upper air, those within the interior of the earth, and a third class that frequent the waters. The last mentioned are known as *mermaids* and *sirens.* Fairy stories were introduced into France and Germany as early as the 12th century. They became generally popular in the latter part of the 17th century, the Italians taking the most extended interest in them. Literature in all countries abounds more or less with fairy tales. Among the best collections of later times are those of the Grimm brothers in Germany, Knightley's and Craker's in English, and Hans Andersen's in Danish. Many fairy tales and legends have been translated into modern languages and in this way became the common property of all. The translations have been devised suitably for home and school reading. Many of the eminent teachers, among them Herbart, Froebel, and Pestalozzi, have recommended them as of special value in child culture during the formative period. Their use for that purpose in American and European schools is very extensive.

It is quite probable that fairy tales and legends are the outgrowth of mythology and folklore. Since primitive peoples are unable to express ideas in the abstract, their customary forms gave rise to the use of familiar and concrete terms. The mystery of storms, zephyrs, caves, ocean waves, mountain echoes, passage of clouds, and the strangeness of life and death all had more or less influence to impress them with awe and to inspire and amaze. The early history passed from generation to generation,

not in written story, but as a living tale, and later became perverted in mythology, folklore, and fairy tales. To their own legends were added those of near or distant peoples, by which the tales they told grew into vast numbers and took on diversified and complicated forms. The giant stories of the Orient, the one-eyed Cyclops tales of Asia Minor, and the mysteries of the Greek and Roman gods were capable of almost indefinite expansion and contraction, especially when brought in contact with the northern heroes and the tales of the *Nibelungenlied*. In pondering the early peoples it is not difficult to comprehend how the folklore, mythology, and hero worship became prolific sources for the growth of numerous and diversified tales, and, associated with the romance of the ages, gave rise to a vast number of stories that have come down to us. Many of the fairy tales remain highly interesting and fruitful objects of study.

FAIRMOUNT (fâr'mount), a city in West Virginia, county seat of Marion County, on the Monongahela River, 75 miles southeast of Wheeling. It is on the Baltimore and Ohio and other railroads. The surrounding country is a farming and coal-producing region. Among the noteworthy features are the county courthouse, the high school, and a State normal school. The manufactures include earthenware, flour, cigars, machinery, and furniture. It has systems of electric lighting, sewerage, and waterworks. Population, 1900, 5,655; in 1920, 17,851.

FAIR OAKS, a railroad station in Virginia, near the Chickahominy River, in Henrico County, six miles east of Richmond. It was the scene of a battle between the Confederates under General Johnston, numbering 38,000 men, and a detachment of General McClellan's army under Gen. Silas Casey (1807-1882) and General Keyes, including about 11,000 troops. The engagement at Fair Oaks took place on May 31, 1862, after General Johnston had retreated from Williamsburg toward Richmond, and was the first important encounter between the army of the Potomac and the army of northern Virginia. General Longstreet drove the Federals back toward the Chickahominy and at nightfall the victory seemed to rest with the Confederates. However, the following day the Federals were reënforced and the battle continued at Seven Pines, about a mile east of Fair Oaks, when the Confederates were repulsed and withdrew to the immediate vicinity of Richmond. The loss on the Union side in both engagements was 5,031 and on the Confederate side, 6,134 men. General Lee succeeded General Johnston while the battle was in progress and General McClellan likewise succeeded General Casey. The battle ground may be reached by an electric railway. A national cemetery is maintained at Seven Pines.

FAIRWEATHER, a mountain on the western coast of North America, in Alaska, between Glacier Bay and the Alsek River. Southeast of it are a number of elevated peaks, including Mount Crillon. It is 15,292 feet above the sea, is covered perpetually with snow, and is the source of several glaciers.

FAITH CURE, the treatment of diseases without the use of drugs, usually practiced by making an appeal to the hope or belief of the patient. It differs from hypnotism and healing by mental science in that its methods require the exercise of religious faith, but the term *faith cure* is applied in a broader sense by some who believe in treating diseases without employing material means, and when applied in this form it includes every method of treatment in which the patient is to rely upon hope and faith. The practice of using home remedies and patent medicine is sometimes designated as a form of faith cure and some include Christian Science, but the latter term is not admitted to be similar by those who believe in it.

Faith cure is not of modern origin, but instead, dates from the most ancient times. That prayer is of utility in effecting cures has been taught by the Christian Church from its origin, and many eminent divines have preached that prayer is potent in the cure of bodily ills as well as in the forgiveness of sin. Some have gone so far as to teach that the atonement includes the healing of the body, since, as they believe, God would be dishonored if it were claimed he could not do more than preserve the soul. To this class belongs A. B. Simpson, of New York, who anointed with oil and practiced the apostolic methods. John Alexander Dowie, first apostle of the Christian Catholic Church, taught that diseases may be cured by prayer and the laying on of the hands. In the chapel of that church at Zion City are many canes, crutches, and trusses that are claimed to have been left there by people who came diseased and crippled and went away healed. Many others could be named who practiced the art and professed to effect cures. Those who believe in some form of faith cure have multiplied greatly within the last few decades.

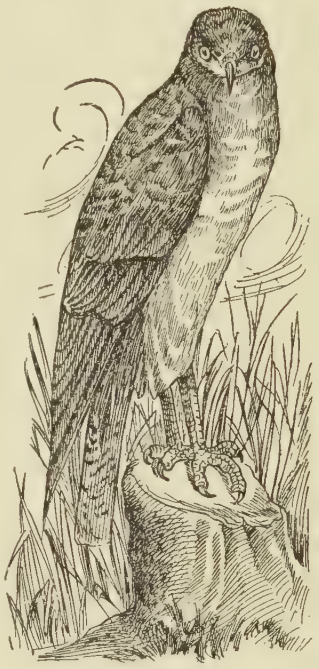
While the cure of diseases and the treatment of patients must necessarily involve the use of material means and the employment of drugs, it is admitted on every hand that hope and expectation are mental states of great utility in those who suffer pain and disease. Digestion is favored by happiness, emotions stimulate action of the bladder, and sorrow causes secretion of tears in the lachrymal glands. There is no difference between those who practice medicine and those who believe strictly in faith cure so far as the favorable influence of hope and expectation is concerned, but the disagreement lies in the fact that one employs drugs and other material means, while those who hold distinctly to faith cure rely exclusively upon

some mental or psychological influence, or place reliance wholly in the efficacy of prayer. No doubt, many forms of nervous diseases can be remedied by faith-cure methods. However, their efficiency in the treatment of other ailments likely depends largely upon improved conditions of living and a change to better conduct and habits. It is undoubtedly natural for those who become converted to a new teaching, or a different plan of living than that they formerly embraced, to have mental changes which influence, more or less. In some diseases, such as consumption, cancer, and diphtheria, few if any cures are reported, though conditions are frequently improved.

FAITHFUL (fāth'fụl), **Emily,** authoress, born in Headley Rectory, Surrey, England, in 1835; died June 3, 1895. She was the daughter of Rev. Ferdinand Faithful, and received a fair education at a school in Kensington. In 1860 she established a typographical business in London for women compositors, with the approval of Queen Victoria, which was called The Victoria Press. She founded the *Victoria Magazine* in 1863, in which the wider recognition of women in public affairs was advocated. Soon after she went upon the lecture platform and addressed many literary and philosophical societies in behalf of the improvement of the condition of working women. She visited Canada and the United States three times to study the industries employing women and the religious aspect, particularly the practices of the Mormon Church. Queen Victoria made her publisher in ordinary to her majesty and granted her a pension of $250. She visited the Queen of Rumania in 1890 at the request of Victoria, for the purpose of recounting the opportunities for the employment of women in England. Among her publications are "Victoria Regia," "Change upon Change," "Three Visits to America," "Drawbacks Connected with the Employment of Women," and "Original Contributions in Prose and Poetry."

FAKIR (fā'kẽr), a Mohammedan religious mendicant who wanders from place to place. A fakir is regarded by the common classes of Mohammedans as a character of sanctity, though fakirs are of the lowest priesthood. The term is applied by some writers to the Anglo-Indian and the Hindu mendicants, but the latter are more properly called *Gosavee.* In some regions of the Mohammedan countries they live in communities, but usually the life is solitary. Their attire is coarse and generally black or brown, while the headwear consists of a black turban, over which is tied a red handkerchief. To gain the veneration of the lower classes, they often mutilate their persons and practice absurd penance.

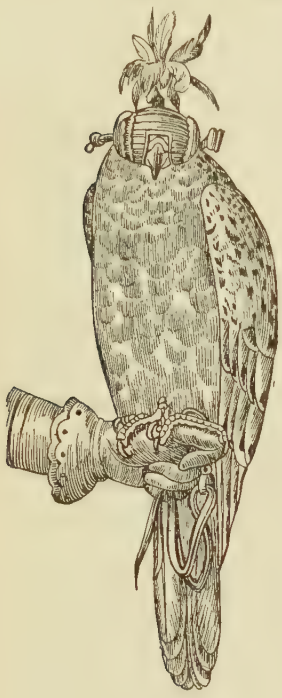
FALCON (fạ'k'n), a long-winged, high-couraged, raptorial bird, which takes its prey as it moves in the air. Technically, in falconry, the female alone is termed a falcon, the male, which is smaller and less courageous, being known as a *tiercel* or *tiercelet.* Naturalists generally apply the name falcon to various birds of prey, which they separate into distinct groups, including the *peregrine falcon, northern falcon, desert falcon, merlin,* and *hobby.* For symmetry, strength, and power of flight the falcon is the most perfect of the feathered race. The beak is strong and short-hooked at the point, the upper mandible having a notch or tooth on its cutting edge. In all species the legs are heavy and stout, the claws are sharp and long, and the wings are powerful. The average length of falcons is about two feet. The peregrine is most commonly used in falconry and is exceedingly swift, its flight being fully 65 miles per hour.



NORTHERN FALCON.

FALCONRY (fạ'k'n-rў), or **Hawking,** the pursuit of game by means of falcons or hawks. In ancient times the sport was called hawking, when the hawk was employed, but later the peregrine and other falcons became popular. The history of this pastime has been traced back to a period prior to the Christian era. At one time, in Germany, even kings and nobles devoted the greater portion of the hunting season to it. After the Norman Conquest, England indulged in the sport until the rank of the individual was indicated by the particular species of hawk carried on his gloved hand or wrist. Later it went largely out of fashion, but at present an attempt is being made to restore this sport, which is attended with growing success. The training of hawks is a matter requiring much care and patience. They are usually taken while young and hooded with a piece of leather, leaving an aperture for the beak, and are trained to sit on the hand and to eat from the lure. The lure is a device made of a piece of wood or leather covered with the wings and feathers of a bird and attached to a cord, to which a piece of meat is fastened. The fal-

coner swings the baited lure round and round his head, accompanying the action by some call. When the falcon has been taught to obey the lure, it is trained to catch live birds, and soon learns to seize the game. The hood is kept on the falcon during hunting excursions, until the bird is wanted to fly.



HOODED FALCON.
(ready for use)

FALK (fälk), **Paul Ludwig Adalbert**, jurist and statesman, born in Silesia, Germany, Aug. 10, 1827; died July 7, 1900. He was educated at the University of Breslau, entered upon the practice of law in 1847, and became counselor of the court of appeals at Glogau in 1862. When the North German Confederation was formed, in 1867, he was elected a representative. The following year he was appointed privy counselor to the minister of justice, in which capacity he aided in codifying the laws of the German Empire. In 1872 he became minister of public worship and instruction, and, when Prince Bismarck decided to curtail the privileges of certain church worship, he brought forward the repressive measures known as the May Laws. When negotiations for the restoration of harmony between the state and church were begun in 1879, he retired from office, accepting at the same time a peerage for his son. He was appointed to the presidency of the court of Hamm in 1892.

FALKLAND ISLANDS (fąk'land), a group of islands belonging to Great Britain, situated in the South Atlantic Ocean, about 295 miles east of the Strait of Magellan. The total number of islands is about one hundred, with an area of 6,490 square miles, of which the two larger are East Falkland and West Falkland, containing respectively 3,000 and 2,300 square miles. The surface is hilly, with bogs extending from various points on the shore toward the interior region. Forest trees are entirely absent, but many grasses abound, on which herds of cattle and sheep are reared with much success, this constituting the principal industry. Many penguins and other sea fowls are native to the islands. The fisheries are valuable. The climate is healthful and well adapted to the production of cereals found in temperate climates.

The Falkland Islands were discovered by John Davis (1550-1605), Aug. 14, 1592, and were named by Captain Strong while cruising in 1689, in honor of Lord Falkland. Stanley, on East Falkland, with a population of 916, is the capital. Population, 1922, 3,065.

FALL, Albert Bacon, public man, born at Frankfort, Ky., Nov. 26, 1861. He was principally self-taught, but attended public schools, became a teacher and later a lawyer, and subsequently was largely interested in mining, lumbering, farming and cattle raising. After serving in the legislature of New Mexico, he was chosen United States senator, in 1912, and subsequently was re-elected. He was Secretary of the Interior from 1921 until 1923.

FALLACY (făl'lă-sĭ), in logic, an invalid process of reasoning, which leads to an erroneous conclusion. Since fallacy is a violation of some logical law, many rules have been devised to govern sound reasoning and when one of these is violated the result is a logical fallacy. No agreement has been reached as to the proper classification, though the subject has been one for extended discussion from remote antiquity. Writers usually divide fallacies into three classes, assumptions, sophisms, and aberrancies.

An assumption is that which is taken as true without evidence. It may be true or false; but, resting on no basis of evidence, it is, in both cases, invalid, not because it is known to be false, but because it is not known to be true. To assume an assumption false, because of its lack of evidence, would be a procedure as invalid as to assume it true. Assumptions arise from want of attention, superstition, prejudice, hasty generalization, and preconceived opinions.

A sophism is an invalid argument, and may be said to constitute a fallacy that is designed to deceive. It originated from the Sophists of ancient Greece, who doubtless cared little for truth or morality, and merely professed to teach how to make the worse appear the better reason. Sophistry is a fallacious reasoning which is sound in appearance only and puzzles the inquirer after truth.

An aberrancy is a wandering from the conclusion warranted by the premises and drawing another which is unwarranted. One who infers the reasoning valid because the conclusion is true is misled by an aberrant fallacy, since it does not follow, because the conclusion is true, that the argument is valid. Many unsound arguments have escaped detection, because the conclusion of the speaker coincided with the opinions of the hearers. Again, one who infers that the conclusion is false because the premises are false, or the reasoning is illogical, is misled, since the proper inference is not that the conclusion is false, but that it is not proven.

FALLIERES (fà-lyâr'), **Clement Armand,** President of France, born at Mézin, France, Nov. 6, 1841. He studied in his native town and took up the practice of law, but went into politics. In 1876 he was elected to the Chamber of Deputies, where he soon distinguished himself, and was minister of the interior in 1882, 1883, and 1887. He was made minister of public instruction in 1883 and subsequently became minister of justice. In 1890 he was elected to the Senate, was reëlected in 1897, and in 1899 became president of the Senate. He was elected President of France in 1906 to succeed Loubet.

FALLING BODIES, a term used in physics when demonstrating the force of gravity. All terrestrial bodies, if unsupported, fall or move toward the earth's center by this force. That the acceleration due to gravity is the same for all masses was proved by Galileo. His experiments consisted in dropping unequal balls of iron from the top of the leaning tower of Pisa. He discovered that, whatever their masses, the balls reached the ground at the same instant. Using balls of iron and wax, he found that the iron balls struck the ground first. From this phenomenon he concluded that bodies less dense are similarly influenced by gravity, but that the unequal velocities are due to the resistance of the air acting on different extents of surface. It was later demonstrated by Newton that all bodies in a vacuum fall with the same velocity, which proves that the effect of gravitation on bodies is proportional to their masses, but the resistance of the air causes the apparent exception to the law.

In a body falling freely from a state of rest, the velocity at the end of the first second is equal to about 32.16 feet per second. At the end of the next second it is 32.16 times two, and equals 64.32 feet per second; at the end of the third second it is 144.72 feet, etc. If the time is known, the distance through which a falling body passes may be found by multiplying the square of the time in seconds by 16.08. Thus, in two seconds, 2x2x16.08=64.32. The acceleration varies in different parts of the earth's surface, being least at the Equator and increasing slightly with the latitude to a maximum at the poles.

The distances fallen by an unsupported body in successive seconds increase at the odd numbers. Thus, a body falling from a state of rest passes through 16.08 feet during the first second, and attains a velocity of 32.16 feet. During the next second it falls through 3x16.08 feet, or 48.24 feet, and the third second, 5x16.08 feet, or 80.40 feet. The total distance in feet through which a body falls in a given time is proportional to the square of the time, and is equal to the square of the time in seconds multiplied by 16.08. Thus, a falling body passes four times as far in two seconds as in one second and nine times as far in three seconds as in one second. In the first second a body falls 16.08 feet, and in the next second it falls 48.24 feet. At the end of the second second it has fallen through a total distance of 48.24+16.08=64.32 feet. Thus, 64.32 feet is four times 16.08 feet, or 2x2x16.08, as per the statement above.

FALLOW DEER (făl'lō), a species of deer native to Europe and Northern Africa. In a wild state it is found chiefly in the mountainous regions of the southern part of Europe, but it is very common in the parks and forest reservations. The male or buck has palmated antlers, about 25 inches long, and is somewhat larger than the female or doe, which is without horns. It has a brownish color, characterized by pale spots, and the hair is smooth and fine. The young fawn is mottled and accompanies the mother at an early age. Fallow deer go in herds under a master, an old buck, who keeps an outlook for danger and appears to command the herd. The flesh is highly esteemed for food.

FALLOW LAND, the name applied to ground which is left untilled in crops, but is plowed in the summer, as a means to regain productiveness after continuous cultivation. Such plowing is usually called summer fallow. All land, no matter how productive, if used continually for a number of seasons, becomes partly exhausted, and this method is employed to allow it to rest and recover its fertility. In other instances various forms of fertilizing are used for the same purpose. Strictly speaking, the land should remain idle the entire year, but the term is likewise applied to various modes of treatment, such as plowing the ground immediately after the removal of a spring crop, known as bastard fallow; or planting the ground with some crop that can be planted in rows, as corn or potatoes, which admits of the intermediate spaces being cleaned, stirred, and pulverized during the growth. The latter is known as green-crop fallow.

FALLOWS, Samuel, clergyman and educator, born in Pendleton, England, Dec. 13, 1835. When ten years of age, he came to the United States, graduated at the University of Wisconsin in 1859, and was elected vice president of Gale College, Galesville, Wis. The Methodist Church ordained him as minister in 1861. Soon after he entered the Union army as chaplain. Owing to his persistent courage he became known as the "fighting parson," attaining the rank of brevet brigadier general. Shortly after the war he accepted a pastorate in Milwaukee. In 1871 he was elected State superintendent of public instruction of Wisconsin, to which office he was twice reëlected. He became president of the Illinois Wesleyan University in 1874 and rector of the Saint Paul's Reformed Episcopal Church of Chicago in 1875, and the following year engaged as editor of the *Appeal.* He published a number of important educational works, including "Hand-

book of Synonyms," "Dictionary of Synonyms and Antonyms," "Handbook of Americanisms and Britainisms," and "Students' Bible Dictionary." He died Sept. 5, 1922.

FALL RIVER, a city of Massachusetts, in Bristol County, on the Taunton River and Mount Hope Bay, an arm of Narragansett Bay, about fifty miles southwest of Boston. It is on the New York, New Haven and Hartford Railroad and many electric railway lines. The site is at the head of deep-water navigation, forming the terminus of steamships from New York and other ports. It is the greatest cotton goods manufacturing city in America, employing about 3,200,000 spindles. The products include calico, yarn, gingham, and thread. Calico printing and the dyeing of cotton goods are extensive enterprises. Other manufactures include nails, boots and shoes, soap, rope, rubber, machinery, and granite quarry products.

Fall River is a modern and regularly platted city. The streets are well graded, lighted, and paved with stone and macadam. Among the public buildings are the city hall, the United States customhouse and post office building, the State armory, and the public library. Other buildings of note include the Y. M. C. A. Building, the Fall River Conservatory of Music, the Notre Dame College, the Union Hospital, and the Elks Building. In 1887 the Durfee high school building was donated to the city. It is a fine structure of granite and is well equipped with apparatus for teaching the sciences. Fall River was a part of Freetown until 1803, when it was incorporated under its present name. In 1804 it was named Troy, but the present name was restored in 1834. The early growth of the city was due to an abundance of water power obtained from Fall River, the outlet of Watuppa Lake, which is located on the eastern border of the corporation. Population, 1905, 105,697; in 1925, 128,993.

FALSE IMPRISONMENT, the unlawful restraint of one's liberty by detention without authority of law. The false imprisonment of a person is a crime, whether the detention is in a prison, police station, or a private house, even if confined without bars or bolts, and a person guilty of the offense is liable to prosecution as well as reparation to the party injured. However, several exceptions are made, such as detaining a madman or persons who are known to have committed a crime. Other exceptions are those made in favor of parents, guardians, and teachers, who restrain children under their authority within reasonable limits.

FALSE PRETENSES, in law, the willful misrepresentations of fact to obtain money or other property of value. Any person who is guilty of obtaining a valuable consideration in this way may be punished by fine or imprisonment or both. However, the pretenses must relate to a fact or state of facts which are represented as existing at the time or already passed. Representation or promises as to what a party will do or what facts will occur in the future, no matter how false or groundless, are not considered misdemeanors. Besides, the party claiming to be defrauded by a false pretense must have relied upon the representations as true.

FALSETTO (fal-sĕt'tō), in music, the artificial tone of the voice. The voice contains three registers—chest voice, head voice, and a third, which is not natural, and is called falsetto or false voice. It is usually blended, by practice, with the chest voice so as to make no perceivable break.

FAMILY COMPACT, the name of an alliance concluded between France and Spain in 1761. It was designed to unite all the branches of the house of Bourbon as a counterpoise to the maritime ascendency of England. By its terms the American colonies secured the aid of Charles III. of Spain, and Pitt proposed to declare war against that country, but he was outvoted and resigned.

FAMINE (făm'ĭn), a widespread and distressing scarcity of food, usually resulting from drought, war, flood, or insects. Tropical climates subject to irregular rainfalls are most commonly affected by famines, though defective economic systems, such as the absence of articles of food and imperfect means of transportation, are prolific causes. In the Middle Ages famines were more numerous than at present for the reason that modern communication and transportation makes it possible to supply quite successfully the districts in want with the necessary means of sustenance. The most widespread famines of recent times have been experienced in Asiatic countries, particularly in India and China. The great famine visiting northwestern India in 1837-38 caused 800,000 persons to perish, and the one occurring in Bengal and Orissa in 1865-66 resulted in about a million deaths. In 1847 a famine visited Bengal, but it was not excessively destructive of human life for the reason that supplies were transported rapidly to the afflicted districts, though nearly a half million died during the great famine in 1877, which visited Bombay, Mysore, and Madras. It is estimated that 9,000,000 persons perished at the time of the great famine in China in 1877-78, while the one in 1888-89, caused by the overflow of the Yellow River, was equally destructive. One of the most remarkable famines of India occurred in 1897, which was followed by a very destructive and widespread dearth of food in 1900. The most destructive famine of recent times visited China in 1902, when about a million people died of starvation.

FAN, an instrument for agitating the air by the movement of a flat surface, especially for cooling the face or causing the movement of air in a room. Devices for cooling the face by agitating the air were in use among the Greeks and Romans, and were introduced into

western European countries shortly after the Roman invasion of Gaul and Germany. Those generally used are made of palm leaves, feathers, thin skin, wood, paper, or ivory, and are of various construction. Ventilating fans are propelled by steam or electric power. Those of the latter class have a simple motor with alternating electric currents, a fifty-volt transformer current usually being sufficient to propel the fan. These ventilating fans are frequently seen in department stores, offices, and dining rooms, where currents of air are put in motion for the cooling effects. In mining, for winnowing grain, urging combustion, cooling fluids, and other purposes contrivances of flat disks or waves are utilized, which, when propelled by machinery, revolve rapidly and induce strong currents, the force of the current depending upon the velocity at which the fan moves. See **Blowing Machine.**

FANATICISM (fȧ-năt'ĭ-sĭz'm), the term used to designate intemperate zeal or ferocious enthusiasm. The spirit of fanaticism has frequently characterized political and religious movements, in which advocates of reforms were unduly enthusiastic, and often resorted to radical measures in endeavoring to further their ends.

FANCY (făn'sy), in psychology, a term used in connection with imagination, of which it is a form. When the imagination combines the subjects it uses in such a way as to give a result that is pleasing, light, and playful, but still shows nothing of high purpose or of noble and cultivated taste, it is called fancy. Images of the fancy are dealt with by many of the poets and orators. The comparison made by Longfellow, in which the moon is likened to the paper kite of a school boy, is a mere fancy. In early life the imagination inclines more commonly to the fanciful. This is evidenced by the productions of great writers, particularly of Shakespeare, whose early writings partake more of the fancy than do his later productions.

FANDANGO (făn-dăn'gō), a famous dance of the Spanish people, dating from the Moorish occupation of Andalusia, though it is rarely danced, except at theaters and in parties given by the lower classes. It is said to have come into favor on account of the ecclesiastical authorities in Spain threatening to prohibit dancing. Accordingly, two parties were brought before the judges of a court, in which the fandango dance was given, and this resulted in its approval. In this form of dancing the parties never touch each other, but retreat, approach, and pursue each other in varied movements, voluptuousness being indicated by the movements.

FANEUIL (fŭn'ĕl), **Peter,** merchant, born in New Rochelle, N. Y., in 1700; died March 3, 1743. He descended from a family of French Huguenots. His parents removed to Boston, where he became the head of a successful mercantile business. In 1742 he erected a public market at his own cost and gave it to the city. The building was destroyed by fire in 1761, but was rebuilt by public taxation in 1763 and was used as a theater in 1775. At the time of the Revolution the Americans selected it for a meeting place, from which it came to be called *the cradle of liberty,* and those taking part in the meetings were known as *Sons of Liberty.* Faneuil Hall was remodeled in 1805 and one story was added. The main hall is eighty feet square. Pictures of distinguished Americans decorate its walls.

FAN PALM. See **Palms.**

FARADAY (făr'ȧ-dȧ), **Michael,** distinguished chemist and philosopher, born at Newington Butts, near London, England, Sept. 22, 1791; died Aug. 25, 1867. He was the son of a blacksmith, was apprenticed to a bookbinder when thirteen years old, and showed a very early aptitude for the study of science and electric machinery. When Sir Humphry Davy lectured on chemistry at London, in 1812, he obtained admission, and was soon after appointed assistant at the Royal Institute. He succeeded Davy to the chair of chemistry in 1827, and five years later was created a doctor of civil law. His valuable researches were carefully noted and much useful information regarding them was afterward published in various works which are still held in high repute. The notable discoveries made by him include new compounds of carbon and chlorine, compounds of carbon and hydrogen, and numerous alloys of steel. In 1829-30 he made a series of experiments in the manufacture of glass for optical purposes. Later he experimented successfully in magnetism and electricity, which resulted in several useful discoveries. Oxford conferred upon him an honorary degree in 1832 and the academy at Berlin, Germany, made him an honorary member. Lord Melbourne granted him a pension of $1,500 a year, beginning in 1835, and a house at Hampton Court was given him in 1858. Among the most valuable works published by him are "Lectures on the Forces of Matter," "Researches in Electricity," "Chemical History of the Candle," "Non-Metallic Elements," and "Chemical Manipulation."

FARALLONES (făr-rȧl-lōnz'), an island group off the coast of California, situated thirty miles west of the Bay of San Francisco. It belongs to the State of California. The group consists of six islands, on the largest and most southern of which is a lighthouse with a flash light of the first order, at an elevation of 360 feet above sea level. Great numbers of gulls and murres breed on these islands and furnish vast quantities of eggs, which are gathered for the market of San Francisco. Many sea lions and several species of seals frequent the group.

FARCE. See **Drama.**

FAR EASTERN QUESTION, the problem of international politics which at present

is receiving attention from the leading nations of the world. In respect to territory it refers to Farther Asia, which in this sense includes all of the eastern portion of that grand division. It may be said that this issue of international politics dates from the time Prince Henry the Navigator explored an eastward route to the Indies, since which time the leading European powers have sought to control both the territory and commerce of the Orient. However, the beginning of the 20th century intensified interest in Far Eastern politics, particularly since the means of navigation have been improved and railroad building has become greatly extended, by which changed conditions western people have been enabled to compete more successfully in the Asiatic market.

The rise of Japan as a political power is a potent factor in the Far Eastern Question, and the war between Japan and China in 1894-95 is the beginning of an important epoch. The United States became more directly interested by annexing the Philippines in 1898, though it had already established itself as a factor by the annexation of the Hawaiian Islands. The policy of the United States has been to advocate the preservation of the integrity of China, and it has insisted that all nations, irrespective of spheres of influence, be granted equal rights of trade in the Chinese Empire. Russia has long sought preponderance in Manchuria, principally because the control of that region is an essential in securing a broad outlet to the Pacific for the great Siberian railway system. However, Russian influence became greatly lessened through the fortunes of war with Japan, and the latter country is not only a claimant to consideration, but is destined to exercise a wide influence in forming the future policy in regard to China and its industrial development. Germany, Great Britain, and France are the other three powers most concerned, since each has a foothold on the eastern shore of Asia. The trade of Shan-tung and the fertile valley of the Yellow River are largely in the hands of Germany, while Great Britain is strengthening her position in the Yangtze valley, and France is endeavoring to cross China with a railway line from French Indo-China to connect with the Trans-Siberian Railway in Russian or Japanese territory.

In 1900 occurred the Boxer outbreak against foreigners, which was designed to preserve China for the Chinese. The promoters of this movement look upon railroad building as particularly favorable to the nations that advocate establishing spheres of influence until all of China is controlled by the commercial nations of Europe and America. No doubt the whole question will turn upon railroad building, and already transcontinental lines have been projected both north and south. When completed these lines will carry a vast trade and furnish the means which will bring Europe into control, as well as open and maintain a wide market for the manufactures produced by modern methods.

FAREL (fä-rĕl'), **Guillaume,** eminent reformer, born in Gap, in Dauphiné, France, in 1489; died in Neuchâtel, Switzerland, Sept. 13, 1565. It was the wish of his parents that he should engage in a military career, but he chose to pursue the calling of the ministry, and accordingly obtained admission to the University of Paris. He first supported the Roman Catholic Church with marked devotion, but afterward became converted to the reformed faith, and labored with much zeal to spread the new doctrine in Switzerland. His success was most marked in Basel, Berne, and Geneva, where he secured a large following by reason of powerful sermons. The work of Farel had a marked influence on the life of Calvin, Erasmus, and Faber.

FARGO (fär'gō), a city of North Dakota, county seat of Cass County, on the Red River of the North, opposite Moorhead, Minnesota. It is on the Great Northern, the Northern Pacific, and the Chicago, Milwaukee and Saint Paul railroads. The surrounding country is a fertile region, producing large quantities of hay, wheat, flax, oats, and other cereals. Among the noteworthy buildings are the post office, the county courthouse, the public library, the public high school, and the Protestant Episcopal and Roman Catholic cathedrals. It is the seat of Fargo College (Congregational) and of the State Agricultural College. Island and Woodland parks are public resorts. The chief manufactures include flour, clothing, brick, and machinery. It has a large retail and jobbing trade in merchandise. Electric lights, sewerage, pavements, and public waterworks are among the improvements. It was settled in 1871 and incorporated in 1875. Population, 1925, 24,921.

FARGUS, Frederick John, known as Hugh Conway, novelist, born in Bristol, England, in 1847; died May 15, 1885. He was the son of an auctioneer and joined the navy, and adopted his pseudonym from the *Conway,* a ship stationed in the Mersey. In 1884 he published a novel entitled "Called Back," which had a wide sale and was dramatized by Comyns Carr. Other writings include "A Cardinal Sin," "Living or Dead," "Life's Idylls," and "Slings and Arrows."

FARIBAULT (fâr'ĭ-bō), county seat of Rice County, Minnesota, at the confluence of the Cannon and Straight rivers, 52 miles south of Saint Paul. It is on the Rock Island, the Chicago Great Western, the Chicago, Milwaukee and Saint Paul, and other railroads. The surrounding country is fertile and contains many productive farms and dairying establishments. Among the manufactures are woolen goods, shoes, machinery, and flour. The noteworthy buildings include the county courthouse, the high school, the State institutions for the deaf, dumb, and feeble-minded, the Bethlehem Acad-

emy for girls, the Seabury Divinity College, the Shattuck School for boys, and Saint Mary's School for girls. It has electric lights, pavements, waterworks, and street railways. The principal manufactures are flour, woolen goods, musical instruments, clothing and machinery. It was settled in 1850 and incorporated in 1877. Population, 1905, 8,279; in 1920, 11,089.

FARINELLI (fä-rē-nĕl'lē), **Carlo,** celebrated singer, born in Naples, Italy, Jan. 24, 1705; died in Bologna, July 15, 1782. His voice was developed early in life and showed such a degree of culture that he became a favorite singer among the European monarchs of his time. Philip V. bestowed marked honors upon him, granting him special privileges at the court of Spain, and he was similarly honored by Ferdinand VI.

FARINI (fä-rē'nē), **Luigi Carlo,** statesman and historian, born at Russi, Italy, Oct. 20, 1812; died Aug. 1, 1866. He studied medicine at the University of Bologna and began to practice, but was proscribed for political offenses in 1843. The amnesty proclaimed in 1846 permitted him to return, and soon after he became a prominent factor in political affairs. In 1859 he was made dictator of Modena by Napoleon III., and afterward served in the cabinet of Cavour, whom he aided in promoting the movement for a liberal government. He supported the union of the Italian states under Victor Emmanuel. Monuments were erected to his honor at Turin and Ravenna. He is the author of a history entitled "The Roman State from 1814 to 1850."

FARJEON (fär'jŭn), **Benjamin Leopold,** novelist, born in London, England, May 12, 1833; died in 1903. He descended from Jewish parents and went to New Zealand and Australia in search of his fortune. In 1869 he returned to England and took up the work of a dramatist. His numerous novels deal largely with people in low life, from which fact he has been compared to Dickens. Among his writings are "Blade-o'-Grass," "The House of White Shadows," "London's Heart," "A Fair Jewess," and "The Duchess of Rosemary Lane."

FARLEY, John Murphy, cardinal, born in Newton Hamilton, Ireland, April 20, 1842; died Sept. 17, 1918. He first studied in Ireland, but came to America and attended the provincial seminary at Troy, N. Y. Subsequently he studied at the American College in Rome, Italy, where he was ordained a priest in 1870. In the same year he was made assistant rector in Staten Island, but his ability as an organizer was soon recognized, hence he was recalled to Rome and made private chamberlain to Leo XIII. In 1891 he was appointed vicar-general of the archdiocese of New York, in 1902 became Archbishop of New York, and in 1911 was appointed cardinal. His publications include "Life of Cardinal McCloskey" and "Why Church Property Should Not Be Taxed."

FARMERS' INSTITUTE (ĭn'stĭ-tūt), the organization maintained for the purpose of providing opportunities for discussion and advancement of agriculturists and stock raisers. The plans under which farmers' institutes are organized differ somewhat. In some instances they are conducted under the direction of officials appointed by a board of agriculture, while in others the state or government makes an annual appropriation, by means of which institute meetings may be organized and maintained throughout the agricultural districts. The course of study pursued includes topics relating to improved methods of cultivation, fertilization, care of machinery, stock raising, wool, mutton, and pork productions, transportation to market, beautifying of farm life, and many other kindred subjects. It is usually customary to have experienced professors of agriculture and mechanic arts give a series of lectures in order to bring the practical experience of the central stations in direct contact with the practical cultivators of the soil, the rearers of domestic animals, the workers in dairy establishments, horticulturists, etc. In some instances the institutes are in session for several weeks consecutively, while in others local meetings are held at various points in the county or district, thereby facilitating the attendance of a larger per cent. of the industrial classes.

In some instances, as in Michigan and several other states, the institutes are under the control of a board of agriculture. The state appropriation to defray the expenses of the institutes in New York aggregates annually about $15,000, while in Iowa the appropriation to each county may not exceed $50 per annum. Other states have plans whereby the same object may be attained, though the methods are very much diversified. Similar provisions have been made in Canada. The institute movement has progressed most successfully in the states of the north and northwest and in Ontario and the western provinces of Canada.

FARMERS' ORGANIZATIONS (ôr-gan-ĭ-zā'shŭns), the societies or parties organized by farmers for the purpose of bettering the condition of agriculturists, and influencing legislation favorable to the various lines of agriculture, horticulture, floriculture, stock raising, and dairying. Among the first organizations of this kind was the Patrons of Husbandry, organized by William Saunders, Aug. 5, 1867. This was formed on the plan of fraternal societies, under which certain degrees were given to members. The subordinate lodges or granges organized under the system were governed by the National Grange and numbered about 26,000 in 1890. Later other organizations were formed, having a more or less political significance, among them the National Agricultural Wheel, the National Farmers' Alliance, and the National Farmers' Political League. In 1892 a convention of delegates from the various farmers' organizations, together with delegates of the Knights of Labor

and the People's party, was held in Omaha, Neb. A platform declaring their principles was adopted on the Fourth of July. Among the tenets declared were those of a graduated income tax, free coinage of gold and silver, government ownership of telephones and telegraph lines, reclamation of lands from aliens, and the eight-hour labor law. Gen. J. B. Weaver, of Iowa, was nominated for President and Gen. James Field, of Virginia, for Vice President. The larger farm organizations at present include the Farm Union and the American Farm Bureau.

FARNE ISLANDS (färn), or **Fern Isles,** a group of islands in the North Sea, off the east coast of England, opposite Northumberland. The group includes seventeen islets of rocky formation. Navigation in the vicinity is very dangerous. They were the scene of the heroic deeds of Grace Darling in 1838, when the *Forfarshire* was lost. A tower built to the memory of Saint Cuthbert is on one of the islands. They belong to Great Britain.

FARNESE (fär-nēz'), noted family of Italy that gave many eminent names to the republic of Florence and to the church. It descended from the early part of the 13th century and several branches of it still remain. Among the famous works of art found at Naples are several associated with the Farnese family, among them "Farnese Hercules," "Farnese Bull," and "Farnese Flora." The name of this family was given to the Farnese Palace at Rome, an edifice erected by Pope Paul III., which was designed by Antonio da Sangallo and completed by Michael Angelo. It was formerly the property of the Farnese family, but afterward passed to the ruling dynasty of Naples.

FAROE ISLANDS (fā'rō), a group of 25 islands situated in the North Atlantic, between Iceland and the Shetland Islands. The coast lines are largely rugged cliffs, rising abruptly to a height of 500 to 2,000 feet, while the mountains of the interior contain extensive tablelands, none of which exceeds 3,000 feet above the sea level. These islands belong to Denmark. They are governed by resident representatives appointed under the direction of the king. The inhabitants are descendants of Scandinavian people who settled here largely in the 9th century. Strömö is the largest island and contains the capital, Thorshavn, which has a population of about 1,000. The islands are treeless, but have valuable deposits of peat and coal. Building material and machinery are imported largely from Norway. The chief industries of the people consist of fishing, hunting, and sheep culture. Only seventeen of the islands are inhabited. The religion is exclusively Lutheran. Numerous schools are supported by government grants. Population, 1922, 15,821.

FARRAGUT (făr'ă-gŭt), **David Glasgow,** famous naval commander, born near Knoxville, Tenn., July 5, 1801; died in Portsmouth, N. H., Aug. 14, 1870. He entered the navy as midshipman at the age of nine years, was promoted to a lieutenancy in 1821, and in 1851 secured an appointment as assistant inspector of ordnance. The long period of peace gave him little opportunity to distinguish himself as an officer, though he received a commission as captain in 1855. At the outbreak of the Civil War he was assigned to accompany an expedition against New Orleans and with it set sail in February, 1862. After shelling the city without effect for a week, he succeeded in forcing a passage of the river in the dark on April 25, which caused it to fall and pass into the hands of the Federals under General Butler. Later Farragut took possession of Baton Rouge and Natchez, ran the batteries at Vicksburg, and joined the Union fleet above. He was made rear admiral on account of his success at New Orleans. On Aug. 5, 1864, he attacked the Confederate fleet in the Bay of Mobile and compelled it to surrender, and thereby closed the port of Mobile by a successful blockade. The oversight of the contest was made by Farragut while lashed to the mast of his flagship, the *Hartford,* which is known as one of the most interesting episodes of the war. In 1866 Congress created him a vice admiral, and two years later raised him to the rank of admiral, a rank that had not existed in the United States navy prior to that time. His memory is fittingly commemorated by bronze statues in Washington and New York.

DAVID G. FARRAGUT.

FARRAR (făr'ăr), **Frederick William,** noted clergyman, born in Bombay, India, Aug. 7, 1831; died March 22, 1903. He was educated at King's College, London, and later became a scholar and fellow of Trinity College, Cambridge. While at the latter institution, several university honors were bestowed upon him, among them the chancellor's prize for English verse. In 1854 he became a deacon of the English Church, and was admitted into the priests' order three years later. For five years he held with distinction the head mastership of Marlborough College, in 1876 was appointed rector of Saint Margaret's, London, and in 1883 became Archdeacon of Westminster. As a writer he was as preëminent as in preaching the gospel, and gave to the world several excellent works on religious and moral philosophy, the most important being the "Life of Christ," which appeared in many editions and has been translated into various languages. Among his other productions are "The Wit-

ness of History to Christ," "Life of Saint Paul," "The Early Days of Christianity," "The Eternal Hope," "Messages of Books," "Darkness and Dawn," and "The Fall of Man." He published a number of works of an educational character, among them "Greek Grammar Rules," "Families of Speech," and "Essays on Liberal Education."

FARTHING (fär'thĭng), a coin of Great Britain, the fourth part of a penny. It was first coined by the Saxons, but the copper farthing did not come into use until 1665. A farthing is equal to about one-half a cent in the money of Canada and the United States.

FARWELL, Charles Benjamin, public man, born in the State of New York, July 21, 1823; died in 1903. He removed to Illinois in 1838, was clerk of Cook County a number of years, and in 1861 joined his brother in establishing a prosperous wholesale dry goods business. In 1870 he was elected to Congress as a Republican and was reëlected in 1872 and in 1874. He succeeded John A. Logan as United States Senator in 1887.

FASCINATION (făs-sĭ-nā'shŭn), any irresistable influence which captures or controls the will or intellect. That human beings are fascinated more or less easily by certain natural influences is admitted on every hand, but some go so far as to seek to revive widespread belief in the evil eye, an influence that the superstitious thought existed, and by which individuals could be compelled to act contrary to their wishes. Some naturalists think that certain snakes and other animals have this power over mice, squirrels, and birds, but it has been neither satisfactorily explained nor demonstrated.

FASCISM, a political movement of Italy, instituted by Benito Mussolini in 1921. Patterned on the plan of the Roman legion, it is designed to control the government under a dictator.

FASHION (făsh'ŭn), the prevailing style of usages, ornaments, and dress which is adopted by society and accepted by its members in accord with a general law of interest. The fashions change from time to time. They are supposed to take form in line with the most serviceable in practice and the most elegant and decorous in design. When the various fashions of past ages are examined, it is found that the changes were rapid and marked, and that caprice was more often the cause than utilitarian motives. However, the desire to dress *in fashion,* to have every part of the apparel agree with the accepted style, is noticeable throughout the period of history.

FASHODA (fà-shō'dà), a town of the Egyptian Sudan, on the White Nile. It was occupied by the French under Captain Marchand in 1898. The British demanded its evacuation, but the French refused to comply with this demand until they themselves received commercial concessions in the region of the upper Nile and an approval to the extension of their possessions in the Central Sudan. Fashoda was founded by the government of Egypt in 1867 and is situated in an unhealthful region. It lost its importance after 1898 and was renamed Kodok.

FAST (fâst), the voluntary abstention from food, a practice which originated as a religious discipline. It may be either a total abstinence for a brief time from all food, or only from certain kinds, as meat or leavened bread. The origin of the practice is very obscure, but it probably did not at first occupy nearly so prominent a place in Christian rituals as that to which it afterward attained. Among the ancient Egyptians fasting seems to have been associated with many religious festivals, notably that of Isis, but it was not compulsory. Among the Jews fasts were numerous, but the day of atonement was the only fasting day enjoined by the law of Moses. Mishna speaks of four others commemorating, respectively, the storming of Jerusalem by Nebuchadnezzar, the burning of the temple by Titus, the sacking of Jerusalem by Nebuchadnezzar, and the reception of the news of the destruction of Jerusalem by Ezekiel and other captives. Other fasts were proclaimed by royal or other authority on special occasions.

The New Testament enjoins no stated fasts, but several came into vogue subsequently, the fast of Lent taking the lead. In the 3rd century the Latins fasted on the seventh day. The Council of Mentz, in 813 A. D., ordered a fast the first week in March, the second week in June, the third week in September, and the last full week preceding Christmas. In the Roman Catholic Church there is a distinction between the days of fasting and of abstinence. The principal fast days of that church are the forty days of Lent, All Saints, the Immaculate Conception, Rogation Days, Assumption of the Virgin, Whitsuntide, and the eves or vigils before certain festivals, as before Christmas day. To these are to be added the Ember Days, these being the Wednesday, Friday, and Saturday after the first Sunday in Lent, Whitsuntide, the 14th of September, and the 13th of December. Abstinence is practiced on every Friday.

The Greek Church observes as fast days Wednesdays and Fridays; Easter, 48 days; Christmas, 39 days; and several others. The Episcopal and Anglican churches recognize the fast as being praiseworthy, but give no directions concerning it. Their fasting days are every Friday, except Christmas day; the 40 days of Lent; the three rogation days before Holy Thursday; and the Ember Days at four seasons. The Protestant churches in general do not observe fast days, but uniformly require moderation in eating and drinking wholesome food. However, some denominations, as the Adventists, abstain from certain foods, such as the flesh of swine.

FAT, an animal substance of a more or less oily character deposited in vesicles in the

adipose tissue. It is a compound of oxygen, hydrogen, and carbon, and occurs mainly under the skin and on the surface of muscles, but also collects in considerable quantities around certain organs, as the heart and kidneys. Fat surrounds the joints and is found in large quantities in the marrow of the bones. Being light, soft and elastic, it forms an excellent packing material in the body, giving a rounded contour and smooth surface to the frame. Its chief use is for the purpose of nutrition, but, not being a good conductor of heat, it enables the body to retain a reasonable uniformity in temperature. In extremely cold climates fat is the principal food of man; for instance, the Eskimos subsist almost wholly on the fat of bears, seals, and whales during the season of extreme cold. *Fatty degeneration* is an abnormal condition brought on by defective nutrition or excessive use of alcohol, on account of which fatty granules take the place of healthy protoplasm in the heart, kidneys, muscles, and arteries. The sufferer retains the appearance of health, but is impaired by want of energy and muscular weakness.

FATALISM (fā'ṭal-ĭz'm), the doctrine of an unchangeable destiny, according to which all things are preëstablished by the Creator, or by the fixed laws of nature. It has given rise in theory to doctrines or predestination, and, in moral science, to such systems as those of Hegel and Spencer. The ancient Greeks held to the belief in fate so strongly that they regarded it the controlling power of even the gods, while in modern times the Mohammedans regard all things predestined or decreed by fate, and consider the occurrence of an accident an impossibility.

FATA MORGANA (fā'tà môr-gä'nà), a peculiar kind of mirage seen in Italy, especially between the coasts of Calabria and Sicily. It occurs in still mornings, when the waters are unruffled by breezes or currents, and the rising sun shines down upon the smooth surface at an angle of 45°. Objects upon the opposite shore of Sicily, upon the dark background of the mountains of Messina, are seen refracted and reflected upon the water in mid-channel, representing large and duplicated images. Gigantic figures of men and horses move over the picture, interspersed with trees, castles, and palaces. Anciently it was supposed that the phenomenon is due to the fairy Morgana, hence the name.

FATES, in Greek mythology, the deities supposed to preside over the birth, life, and fortunes of man. They were three in number—Clotho, Lachesis, and Atropos. Clotho held the spindle, Lachesis drew out the thread of man's destiny, and Atropos cut it off. The three were regarded as the regulators of the duration of human existence and the destinies of mortals, and places were consecrated to them in Corinth, Sparta, Olympia, Thebes, and other parts of Greece. In statuary they are represented both as young women and as matrons.

FATIGUE, the weariness which follows a long sustained application of the body or mind. It is a lassitude or exhaustion of strength which is due to continued bodily labor or mental exertion. A reasonable amount of fatigue is beneficial to both the body and mind, since it operates to increase the power of the muscular and nervous tissues, thus giving a larger measure of strength and providing for greater future capability. However, the young and those who have a weak constitution need to exercise care in practicing sustained exertion, since it may have the effect of overtaxing certain muscles or nerves. Excessive muscular fatigue is followed by a loss of the contractile power of the muscle. In the nerves and brain it causes shrinkage of the nerves and a loss of sensibility and mental power.

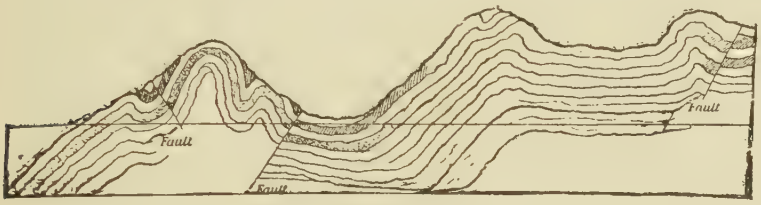
The term *fatigue of materials* is applied to the injury which results from stresses that exceed the elastic limit of materials. If a bar of wrought iron has an ultimate strength of 55,000 pounds per square inch, in which the elastic limit is 25,000 pounds, a single application of a load will not cause a rupture until the ultimate limit of strength is reached. However, when the application exceeds 25,000 pounds per square inch, the molecular structure is altered, causing the iron to become brittle, and a rupture may occur under a stress much less than its ultimate strength, perhaps at 35,000 pounds per square inch. Engineers have formulated elaborate rules governing the fatigue of materials and make allowance for repeated stresses by means of definite formulas. See **Strength of Materials.**

FATIMITES (făt'ĭ-mīts), the descendants of Fatima, the daughter of Mohammed. They constituted a powerful dynasty which ruled Egypt and Syria for more than two centuries, at the time the Abbasside caliphs reigned at Bagdad. They claimed as their founder Ismael, one of the imams who descended from Ali and Fatima, and attained the throne under Adu Mohammed Obeidallah, who became the ruler in 909 A. D. The dynasty was extinguished in 1171, on the death of Adhed, the fourteenth caliph. It was succeeded by a new dynasty established by Saladin the Great.

FATTY DEGENERATION (dĕ-jĕn-ĕr-ā'-shŭn), in pathology, a term which signifies a gradual displacement of the healthy protoplasm by fat globules. These globules have no element essential in life, hence are destructive to the living tissues. They are liable to affect any of the tissues, especially the cellular and muscular, and are a frequent cause of diseases of the heart and liver. Fatty degeneration of the kidneys occurs in many cases of Bright's disease. It is more common in old age, likely due to defective nutrition, and requires careful medical treatment.

FAUBOURG (fō-bo͝or'), the name applied in France to the suburb of a city, or to a district recently annexed to the municipality. Saint Germaine, a fashionable quarter of Paris, is a faubourg of that city.

FAULT, in geology, a displacement of strata of rocks along a plane of fracture. Faults are frequently met with in working beds of coal, the miner coming unexpectedly against an abrupt wall of other strata. The angle this makes in a plane of the bed he is working indicates whether he must look up or down for its continuation on the other side of the dislocation. Beds are thus heaved from a few feet to several hundred or even a thousand feet.



FAULTS IN STRATA OF ROCKS.

FAUNS (fạnz), in mythology, the rural deities who descended from Faunus, King of Latimus. In poetry they are described as creatures with horns, having the figure of a goat below the waist, but being gayer and less hideous than the satyrs. They dwelt in the hills and woods, or were associated with the life on the farm. The fauns are mentioned in the writings of many Roman authors, who associated them chiefly with comic and fantastic scenery.

FAURE (fōr), **François Félix,** president of France, born in Paris, Jan. 30, 1841; died Feb. 16, 1899. He became a shipowner of Havre and served as president of the chamber of commerce of that city. In the Franco-Prussian War of 1870-71 he distinguished himself, and later assisted in putting down the Commune, receiving as a mark of distinction the ribbon of the Legion of Honor. In 1881 he was elected to the Chamber of Deputies as a Republican, and became undersecretary of state, which position he held until 1882. He was chosen a representative in the Brisson cabinet in 1885, became undersecretary of state a second time in 1887, and was made vice president of the chamber in 1894. On the resignation of Casimir-Perier in 1895, he was elected president, receiving 430 votes, while 361 were cast for Brisson. An unsuccessful attempt to assassinate him was made on July 14, 1896. He is author of "Budget of France" and "Principal Countries of Europe since 1888."

FAUST (foust), **or Fust, Johann,** famous printer, born in Mentz, Germany, about 1400; died in 1466. He was associated with Gutenberg in promoting the invention and introduction of printing. Writers generally credit him with furnishing the capital necessary to introduce the printer's art. His methods were preserved as secrets until Mentz was sacked in 1462, after which the workmen settled in different parts of Europe and made known much relating to the apparatus and materials employed. Faust is credited with printing a Bible in the Latin, which is now in the Mazarin library. However, his published works were almost entirely in the German, including various texts, proclamations, and short treatises.

FAUST, Johann, noted magician, who became celebrated in literature as the hero of Goethe's "Faust." It is thought that he was a native of Anhalt, in Germany, and flourished there in the 16th century. He studied theology in Ingolstadt, became a magister at the age of nineteen, and soon after abandoned theology for the study of astrology, medicine, and magic, in which he afterward instructed Johann Wagner, a clergyman's son at Wasserburg. It is said that he made a contract with Satan, which he wrote in his own blood. The terms of the contract provided that Satan was to serve him 24 years, and at the expiration of that time his soul should pass into the possession of the Evil One. Accordingly, the spirit known as Mephistopheles aided him in working the magic arts and in securing visions of the spirit world. This story, though untrue in many details, is made the subject of Goethe's celebrated drama, "Faust," and likewise of Gounod's famous opera known by the same name. The story of Faust and Wagner still forms a conspicuous part in many of the theatricals and operas of Europe.

FAVENC (făv'ẹn), **Ernest,** author and journalist, born in London, England, in 1846. He was educated at Berlin and Oxford and in 1865 removed to Australia. In 1878 he took charge of the Queenslander expedition to explore a large part of the interior of Australia, and visited the region as far north as Port Darwin. Subsequently he explored the western part of Australia. In 1888 he engaged in journalism. His publications include "The Secret of the Australian Desert," "The Moccasins of Silence," "The History of Australian Exploration," and "The Geographical Development of Australia."

FAVRE (fȧ'vr'), **Jules,** statesman, born in Lyons, France, March 21, 1809; died in Versailles, Jan. 20, 1880. He studied law and located at Paris in 1835, where he became prominent as a lawyer and liberalist. In 1848 he became secretary general of the interior and opposed the presidency of Louis Napoleon. He spoke in opposition to the measures which

caused the Franco-German War in 1870-71, though afterward supported the national cause. Later he served as minister of foreign affairs. In 1876 he was elected as senator, distinguishing himself by brilliant oratory.

FAWCETT (fą'sĕt), **Henry,** political economist, born in Salisbury, England, in 1833; died Nov. 6, 1884. He graduated with honors at Cambridge in 1856, studied law at Middle Temple, but soon after discontinued it. While out hunting with his father in 1858, a gun was discharged by accident and caused the loss of his sight. This misfortune did not discourage him, but rather increased his vigor and interest in study. He became professor of political economy at Cambridge in 1863, entered Parliament as an advanced Liberalist in 1865, and two years later married Millicent Garret, who attained a reputation as speaker and writer on the civil rights of women. His earnest work in Parliament tended toward reform measures in India, and caused Epping Forest to be opened for the common people of London. In 1880 he became Postmaster-General under Gladstone, inaugurating several reforms in the postal service. A national memorial at Westminster Abbey was erected to him. He is the author of a number of books, including "A Manual of Political Economy," "The Economic Position of the British Laborer," and "Free Trade and Protection."

FAWKES (fąks), **Guy,** or **Guido,** conspirator, born in Yorkshire, England, in 1570; hanged Jan. 31, 1606. He was the leader in the famous Gunpowder Plot, by which the king and Parliament were to be blown up on Nov. 5, 1605. See **Gunpowder Plot.**

FAYAL (fī-ą'l'), an island of the Azores, belonging to Portugal. It has an area of seventy square miles. A part of the surface is mountainous, rising to a height of 3,290 feet. The soil is fertile and the climate is favorable to Europeans. Among the chief products are live stock, cereals, fruits, and miscellaneous manufactures. Horta, situated on an eminence 3,000 feet above sea level, is the principal town. Population, 1922, 27,045.

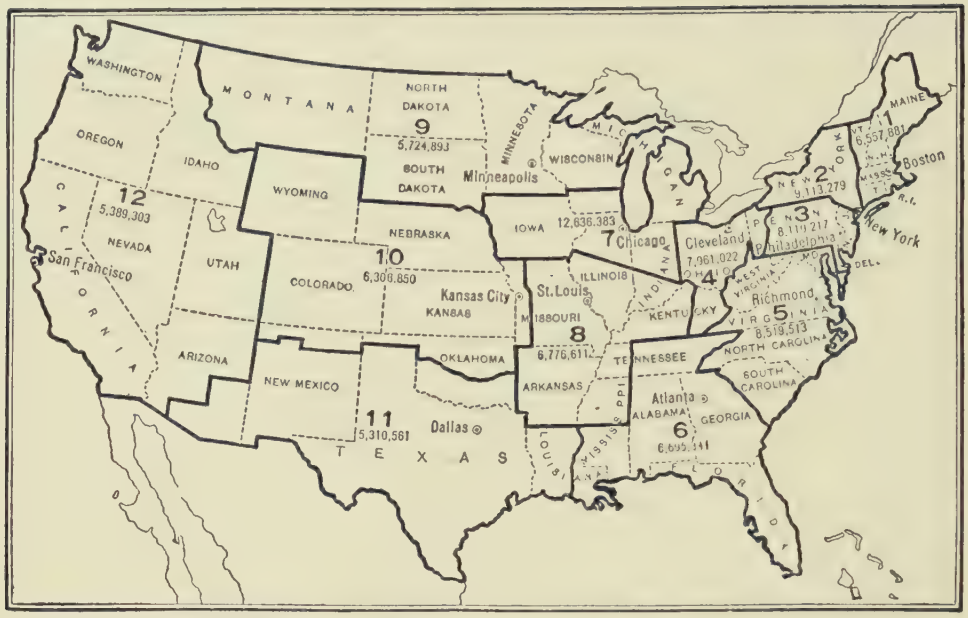
FAYETTEVILLE (fā'ĕt-vĭl), county seat of Cumberland County, North Carolina, at the head of navigation on the Cape Fear River. It is on the Atlantic Coast Line Railroad and has communication by steamship lines. The noteworthy buildings include the county courthouse, the post office, the high school, and the State normal school for colored students. Among the manufactures are cotton goods, lumber, ice, woodenware, and turpentine products. It has a large trade in lumber, cotton, flour, and naval stores. The municipal facilities include waterworks, sewerage, and electric lights. It was settled in 1762 and incorporated as a city in 1893. It suffered severe losses during the Civil War, especially in 1865, when it was occupied by General Sherman. Population, 1920, 8,877.

FEATHER GRASS (fĕth'ĕr), a genus of grasses distinguished by their elegant and featherlike awns. The common feather grass is native to the southern part of Europe, where it is found on the dry hills. It grows in closely matted tufts, having numerous tall flower stalks with small florets, and the leaves have a dark green color. The tufts, if gathered before the seeds are ripe, retain their beauty throughout the winter. The esparto grass somewhat resembles feather grass. A species known as rush-leaved feather grass is native to the western part of North America.

FEATHERS, the dermal growths forming the external covering or plumage of birds. Though chemically similar to the hair on the skin of mammals, they differ widely from it in form and color. As a general rule, feathers consist of a central shaft, which is tubular at the base, and is imbedded in the skin like a plant in the earth. On either side of the *shaft* is a web, beard, or wane consisting of barbs and barbules. Feathers are of two kinds—*quills* and *plumes.* The quills grow mainly on the wings and tail, while the plumes are generally diffused. Being poor conductors of heat, they are useful in preserving the temperature of the bird. They are renewed once or twice a year, which renewal is called *molting.* Some feathers are known as *down* and are the first feathers of the birds. Most birds are provided with an oil gland at the base of the tail, whose secretion the animal distributes at various times over the feathers by means of the bill. Feathers form an extensive article of commerce and are used for ornaments, plumes, bedding, pens, and many other useful purposes.

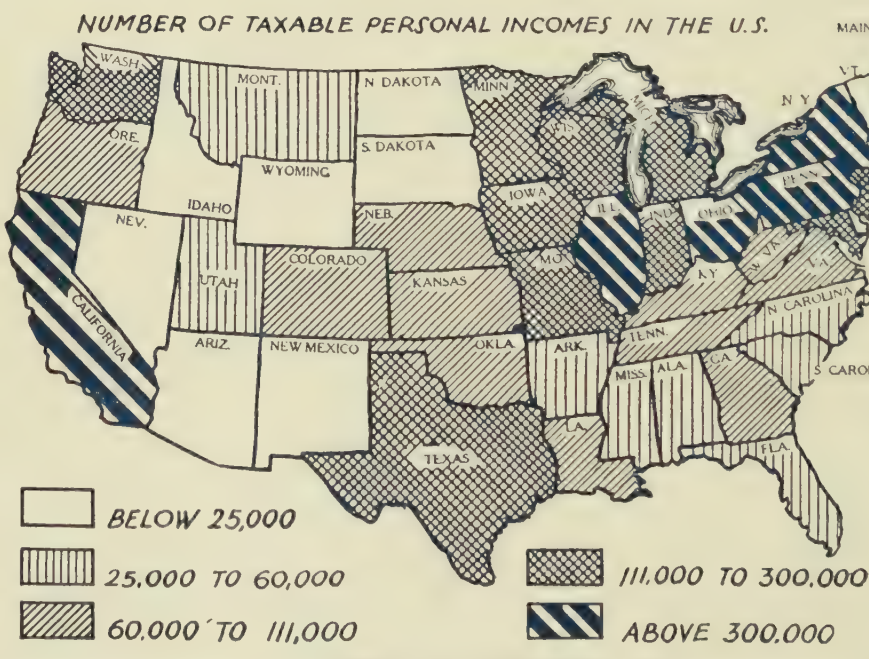
FEATHERS.
Marabou Pheasant Toucon Bird of Paradise Ostrich

FEBRUARY (fĕb'ru-ă-rỹ), the second month in our present calendar. It has 28 days, except in a leap year, when it has 29 days. It was first placed after January by the decemvirs of Rome in 252 B. C. Originally it had 29 days, but, when the seventh month was named after Augustus, a day was taken from it and added to August, making the latter month the same length as July.



FEDERAL RESERVE BANK DISTRICTS

Showing cities which have regional reserve banks and the population of the districts.



WHERE THE TAXPAYERS LIVE

New York leads the list of income taxpayers, with over 1,000,000, and Pennsylvania follows with 621,000, while South Dakota has 21,681 and South Carolina 25,160. A map showing the actual cash in income taxes contributed by the various States would closely parallel the above diagram.

(Opp. 983)

FECHNER (fĕk'nĕr), **Gustav Theodor,** physicist and philosopher, born near Muskau, Germany, April 19, 1801; died Nov. 18, 1887. As a writer on aesthetics he made a wide impression, and interest in his works on philosophy continues to extend as they become better known. His "Elements of Psycho-Physics" has gone through several editions and is considered an epoch-making treatise. Other publications of his authorship include "Regarding the Highest Good," "The Theory of Atoms Relating to the Physical and Philosophical," and "Experimental Aesthetics."

FEDERAL HALL (fĕd'ĕr-ạl), the name of the building used as the capitol in New York City, in which Congress met when that city was the seat of government. It was originally erected as a city hall, located on Wall and Nassau streets, and was rebuilt and placed at the disposal of Congress. However, New York retained the national capitol only a short time, as it was removed to Philadelphia in 1790, whence it was removed to the District of Columbia in 1801. Federal Hall was torn down in 1836 and its site is now occupied by a subtreasury.

FEDERALIST, The, a series of essays published in favor of adopting the Federal Constitution of the United States. They were written by John Jay, Alexander Hamilton, and James Madison, in 1787 and 1788, and appeared in the newspapers over the signature *Junius.*

FEDERAL PARTY, the first political party which had control of the government in the United States after the adoption of the Constitution. When the Constitution had been framed and sent by Congress to the states, in 1787, for ratification or rejection, those favoring acceptance were called Federalists and those opposing it were known as Anti-federalists. The Federal party was led by Washington, Pickering, Adams, Ames, Jay, Hamilton, and Morris. By it the machinery of the new government was established, but in this enterprise the prominent leaders of the Anti-federalists were consulted. The district, circuit, and supreme courts were organized by the Federalists; the departments of State, Attorney-General, Treasury, and War were established; the debt created by the Continental Congress was funded; the debts of the states caused by the Revolution were assumed and funded; plans to repay money borrowed from Holland, France, and Spain were made, and, in 1791, the first national bank of the United States was chartered. A strong opposition to some of these measures was conducted by the Anti-federal party under the leadership of Jefferson, Monroe, Randolph, Madison, Gallatin, Gerry, and others, who afterward became leaders of the Democratic-Republican party. In order to secure the consent of the southern and agricultural states, it was necessary for the Federalists to consent that the national capital be located on the banks of the Potomac River.

The second measure of importance was the founding of the Bank of the United States under the leadership of Hamilton. In 1789 the system of levying duties on imports was commenced. Each of these measures was carried out by a strict sectional vote, and the agricultural sections of the north and the south began to oppose the tariff system, which gave Jefferson and Madison a source of strength in organizing the new party. Later the Federalists endeavored to bring the country into war with France, this being prevented only by the policy of Adams, but it tended to divide the party. In 1798 the passage of the alien and sedition laws forever destroyed its popularity. The party succeeded in the election of Washington and Adams, the latter being defeated by Jefferson, in 1800, for reëlection by a decisive vote. As an opposition party the Federalists took a strict-constructionist ground, while some of its leaders engaged in projects for the disruption of the Union. The policy pursued by the party during the War of 1812, and its general distrust of the people, caused its strength to wane and ultimately destroyed all hopes of permanent success.

FEDERAL RESERVE BANKS, the system of banks established in 1914 by the United States. It is under the direction of the Federal Reserve Board which consists of seven members appointed by the President, including the Secretary of the Treasury and the Comptroller of the Currency. The duties of this board embrace the general supervision of the Federal Reserve Banks, with power to discount paper, to issue federal reserve notes, and perform other banking functions prescribed by law. In its duties it is assisted by the federal advisory board, consisting of one member chosen for one year from each of the twelve federal reserve districts. Each Federal Reserve Bank has a board of nine directors chosen for three years. These directors are divided into three classes, that is three directors representing the stock-holding banks, three representing some industrial pursuit, and three chosen by the Federal Reserve Board. In each federal reserve district is a reserve city, these cities being Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, Saint Louis, Minneapolis, Kansas City, Dallas, and San Francisco.

FEEBLE-MINDED (fē'b'l mīnd'ĕd), the state of being weak in intellectual power, or being mentally infirm, vacillating, or irresolute. It is a form of imbecility and differs from insanity in that it is less violent, being a form of feebleness rather than mental derangement or unsoundness.

Massachusetts established a State institution for the feeble-minded in 1851, the first State institution in America founded exclusively for these unfortunates, and subsequently many of the states established such schools. The education of the feeble-minded is now considered a necessary and important part of the system of public schools, since it provides training for those unfitted to take up the regular work of instruction, and who are not sufficiently infirm

to be taken to hospitals for the insane, since their training must be of a kind which will strengthen them mentally and tend to develop them to the highest degree of efficiency under a system of training which must begin at an early period in life.

Institutions for the feeble-minded are generally located on a large tract of land within easy reach of some town or city. In this way the inmates are removed from harmful influences common to a populous section, and they are brought in contact with the things of nature and the influence of their teachers under more wholesome environments than those associated with the city. These institutions are in fact a home for the idiotic and the imbecile, who remain there permanently or until such a time as their mental condition will permit them to return home, or to fill some function in life safely and independently. The purpose is to keep the inmates occupied in pleasant and agreeable work, and at the same time teach them the rudiments of an education. The educational work is largely in the form of kindergarten exercises, but those capable of mental progress learn to read, write, and sing. The male adults are taught to do work in the garden or orchard, while the females learn to knit, crochet, mend, and embroider. Much patience and diligence is required on the part of the teacher, who has charge of a small number of inmates, and the latter are graded as nearly as possible according to their age and state of mental development.

FEEHAN, Patrick A., Catholic prelate, born at Killenaul, Ireland, Aug. 29, 1829; died July 12, 1902. At the age of sixteen years he entered Castle Knock College, where he studied two years, and shortly after began the study of philosophy and theology at Maynooth College. In 1852 he emigrated to America, was ordained priest in the latter part of that year, and later served as professor of moral philosophy and sacred history in the Seminary of Carondelet. In 1865 he became bishop of the see of Nashville, where he was successful in reorganizing the diocese, which had been demoralized during the war. He founded the Catholic Knights of America, a lay organization which has a large membership. In 1880 he was appointed first archbishop of the archdiocese of Chicago in recognition of the valuable service rendered.

FEELING, in psychology, the power of the mind by which it is capable of experiencing or perceiving a mental act connected with some need or activity arising through the physical or the psychological nature. *Psychical feelings* have a purely mental source and arise from some conception or mental state. They are connected with some desire or activity, are accompanied by pleasure or pain, and ordinarily are preceded by knowledge, leading to volition. The feelings are the source of all joy and sorrow, and furnish the motives in view of which we choose to act or do. At first thought it may appear that knowledge alone leads to volition, but the influence exercised by desire and aversion is too apparent to be left out of account. Feelings are classified as *emotions, affections,* and *desires.* The simple feelings, as of joy and comfort, are emotions; those that go out toward an object, as of love, are affections; and those in which a wish to possess is manifested, as to possess food or clothing, are desires. See **Touch.**

FELDSPAR (fĕld'spär). See **Felspar.**

FÉLEGYHAZA (fā'lĕd-y'-hä-sŏ), a city of Hungary, 65 miles southeast of Budapest, with which it is connected by railway. It is surrounded by a fertile farming country and has a considerable market in fruit, wine, grain, and cattle. The manufactures include pottery, clothing, cigars, and machinery. It has electric and gas lighting, waterworks, and paved and macadamized streets. Population, 1922, 35,403.

FELIX, Antonius, or **Claudius,** Roman governor of Judaea from 51 to 62 A. D. He married Drusilla, who, according to Tacitus, was the daughter of Antony and Cleopatra. The government of Felix, as described by Josephus, was vigorous and successful, clearing the district of robbers and holding the Jews in submission. His connection with Drusilla was questionable, and, when Paul appeared before him and spoke of righteousness and temperance and alluded to the judgment to come, he trembled in fear and consciousness of being unworthy. He was recalled in 61 A. D., when he was succeeded by Festus, but no decision had yet been reached in the cause against Paul. Charges were preferred against him by influential Jews, probably on account of the part he took in suppressing the riots between the Jews and Syrians, and he barely escaped a death sentence.

FELLAH (fĕl'lä), an Arabic word meaning peasant or farmer, applied to a laboring and agricultural class in Egypt. They form the bulk of the population and are descendants of the ancient Egyptians, intermingled with Arabs, Syrians, and other races of Africa and Eurasia. In social position they are inferior to the Bedouins. The men are of medium height, have a dark color, a large head with a facial angle of about 90°, thick lips, and small hands and feet. The women tattoo themselves and marry at an early age. Fellahs exhibit the moral qualities of the ancient Egyptians, being intelligent, grave, and sober on the one hand; but idle, jealous, licentious, and of unbending obstinacy on the other. A few are Copts, but Mohammedanism is the chief religion.

FELLOWSHIP (fĕl'lŏ-shĭp), the name of a position provided in many of the institutions of higher learning, both in America and Europe. The holder of such a positon is called a *fellow,* who is appointed to the place for em-

inent scholarship, the object being to make it possible for him to pursue advanced studies. In some institutions the appointment is for a year only, while in others the period ranges from five to seven years, and the holder of a fellowship receives an annual stipend and other valuable perquisites. The ranks of the faculties are frequently recruited from the fellows. In England many fellowships are tenable for life, though in some institutions, such as Cambridge, they are for a definite term of years. However, the income in England is larger than in America, since the fellows receive from $500 to $2,500 annually. The trustees in some institutions of the United States are called fellows.

FELSPAR (fĕl'spär), or **Feldspar**, a group of minerals which embraces many species. In some form, it is the principal constituent of granite, gneiss, greenstone, and many other rocks, while clays seem to have resulted very generally from its decomposition. The minerals of this group occur in crystals and crystalline masses, are vitreous in luster, and break rather easily in two directions at right angles to each other. The colors are usually white, flesh-red, bluish, or greenish. All kinds of felspar are so hard that they cannot easily be scratched with a knife. They are fused with difficulty, but are quite soluble in acids. Several species are of a fine grade, including those known as potash felspar, lime felspar, and soda felspar. A nearly colorless variety, known as *moonstone,* is often cut into ornaments and is prized almost as a gem. Another species with golden-yellow specks, called *sunstone,* is very rare and beautiful and commands high prices. *Labradorite,* obtained chiefly in Labrador, and *Amazon stone,* found in the Ural Mountains, are esteemed as precious stones. In decomposition felspar not only yields clay, but also the mineral *kaolin,* both of which are essential elements in the manufacture of fine pottery and porcelain. Felspar of commercial value is obtained in Greenland, in the Adirondack region of New York, in the Rocky Mountains of British Columbia and Colorado, and in other sections.

FELT, a kind of cloth made without weaving by taking advantage of the natural tendency of the fibers of hair and wool to interlace with and cling to each other. The materials are carded more or less perfectly, steamed or moistened with hot water, and passed between beaters and rollers which press them into compact cloth or felt. This class of material is used extensively for carpeting and in padding coats, caps, cloaks, and other garments. It is valuable in making table covers, carriage-linings, upholstery work, and piano hammers, and for sheathing boilers and hot-water reservoirs. When saturated with pitch, coal tar, or asphalt, it is used for covering sheds and similar buildings. Beaver hats are made in the same manner of the fur of beavers, rabbits, raccoons, and other animals.

FEMUR (fē'mŭr). See **Skeleton.**

FEN (fĕn), a tract of low land which is subject to overflow, or is partially or wholly covered with water. The name is used extensively in England, where it has reference to the Fens, or Fen District, which consists of a moor or boggy land that produces coarse grasses. These regions have a peculiarly rich soil and are frequently redeemed by drainage and the construction of dykes.

FENCE, an inclosure constructed of posts set in the ground, having fastened to them wire, rails, or boards. The posts are usually of wood, though iron is used for that purpose to some extent, and in regions having a large supply of rocks some fences are constructed of stone. Fences that inclose a yard are commonly made of boards or woven wire, while the larger fields and ranches are fenced with barbed wires. In some sections many fences are made by planting shrubs together closely in rows, such as willow or osage orange, but these are not as common now as formerly, since they require considerable care and to some extent interfere with the growth of crops near the fence line. Barbed wire used for fencing is usually twisted of two strands, and the main wire has barbs from three to four inches apart. It is the chief material in constructing fences, though its use is not permitted in the cities and along the roads in some states, where smooth wire is used instead. See **Wire.**

FENCING, the art or practice of attack and defense with the sword or rapier. The instrument used chiefly is a small sword made to taper gradually from the hilt to the point, and the size depends upon the rules governing the practice. The rapier is a straight sword with a narrow and finely pointed blade, and is used only for thrusting. A blunt weapon called a *foil* is used chiefly in gymnasiums. It resembles a small sword in the main, but is usually lighter and has a button at the point to prevent accidents in practice. Fencing became popular among the noble and knightly class at the close of the 15th century, when it consisted chiefly of rapier and dagger play, and those engaged in the practice were covered with armor or carried a shield. It took first rank as a favorite form of exercise in the schools and gymnasiums of European countries, where it is still practiced quite extensively, but in America it never rose to a place of considerable importance as a school practice. The Amateur Fencers' League of America, which is associated with the Amateur Athletic Union, is the most important fencing organization in the United States. It has four competitive contests each year, the most important being with dueling swords and sabers, while the others are with foils. Fencing teams are maintained by the principal colleges and universities and these hold intercollegiate

contests. New York, Philadelphia, Boston, and Montreal are classed as the leading fencing centers of America.

FÉNELON (fā-nę-lôn'), **François de Salignac de la Mothe,** prelate and author, born in the Château of Fénelon, France, Aug. 6, 1651; died Jan. 7, 1715. He was trained at home until twelve years of age, when he was taken to Cahors, and afterward received a liberal education in Paris. When twenty years of age, he entered the seminary of Saint Sulpice, where he studied theology and was granted holy orders in 1675. In 1678 he was appointed director of an institution in Paris for the reception of females. Being highly successful in attending to the duties incumbent upon him, he was placed at the head of a mission detailed to preach in Saintonge and Poitou. Louis XIV. recognized his ability and appointed him preceptor to his grandson, the Duke of Burgundy, in 1689. His success in this capacity was awarded by a royal appointment to the abbey of Saint Valery and soon after to the archbishopric of Cambrai. The exceptional ability and breadth of character of Fénelon were shown in a long controversy with Bossuet, who had denounced him as a heretic, which ended March 12, 1699, by an adverse decision of the Pope. Perhaps, no life of the 17th century presents a greater devotion to Christianity and the elevation of mankind in moral goodness than that of Fénelon. He is distinguished as an educator chiefly because he advocated the general education of women. His body was buried in the Cathedral of Cambrai. His publications embrace treatises on theology, philosophy, literature, history, and oratory, and have appeared successively in twenty large volumes. The most noted are "The Maxim of the Saints" and "The Temporal Power of the Mediaeval Popes."

FENIANS (fē'nĭ-ạns), the name derived from a class of ancient Irish warriors, the *Fianna* or *Fionna,* founded as home guards in the 3d century. In modern times it was made the name of a political association that has for its aim the forcible liberation of Ireland from British sovereignty. The Fenian movement of the last century dates from 1857, when John O'Mahoney, James Stephen, O'Donovan Rossa, and other prominent leaders established a brotherhood in America. The object was to make the United States the base for operations in Ireland and Canada against the English, the central headquarters being in New York City.

In 1863 large sums of money were collected to organize for aggressive hostilities, and a convention was held at Chicago for the purpose of formulating plans. An attempt to invade Canada was made in 1866, but the object was frustrated by a capture of the stores of arms and provisions by United States authorities. About the same time an uprising in Ireland was suppressed by seizing the *Irish People,* a Fenian publication at Dublin, and arresting a number of leaders. Another effort was made to invade Canada in 1871, which likewise proved unsuccessful. An attempt to destroy British ships and prevent shipbuilding by the use of dynamite was designed in 1883, though the enterprise met with little success, the principal promoters being apprehended and sentenced to penal servitude for a term of years. Within recent years the brotherhood, although having many sympathizers in Europe and America, has not pursued active operations, but organizations are still maintained.

FENNEC (fĕn'nĕk), a small animal of Africa, resembling a small fox. The tail is nearly as long as the body, which has a length of a foot, and the ears are three inches in length. It has a yellowish color, except the tip of the tail, which is black and bushy. The fennec is native to the Sahara Desert and is called Sahara fox by some writers. It burrows in the ground, where it spends most of the day, and at night comes out in search of food. It subsists on insects, birds, mice, lizards, and the tender parts of plants.

FENNEL (fĕn'nĕl), a fragrant umbelliferous plant cultivated in gardens to a considerable extent for its aromatic qualities. The flowers are small and yellow or white, and the leaves, sometimes used in cookery, are finely divided. Among the common species are the giant fennel, common fennel, sweet fennel, and Indian fennel. The seeds are carminative and are used in medicine.

FERDINAND I. (fĕr'dĭ-nănd), sovereign of the Holy Roman Empire, born in Alcala, Spain, March 10, 1503; died July 25, 1564. He was the son of Philip I. and brother of Charles V. of Germany, whom he succeeded as Holy Roman Emperor in 1556. He married Princess Anna of Hungary in 1521, became King of Bohemia and Hungary at the death of Louis, brother of his wife, in 1526, though his claim was contested, but by the aid of the Turks he secured recognition. Ferdinand was elected emperor on the abdication of Charles V., and during his brief reign attained a reputation for ability, justice, and enlightenment. Among other wholesome measures, he reformed the monetary system, conciliated his subjects in religous affairs, and added Hungary and Bohemia to his empire. He was succeeded on the imperial throne by his son, Maximilian II.

FERDINAND II., sovereign of the Holy Roman Empire, born in Grätz, Austria, July 9, 1578; died in Vienna, Feb. 15, 1637. He was the grandson of Ferdinand I., being the son of Charles, Duke of Styria. His education was wholly under the Jesuits. In 1619 he ascended the throne. The training and sentiment of Ferdinand were in strong opposition to the Protestant church, and he began early in his reign to seek the extermination of all holding to that confession of faith. The religious war that commenced in the duchy of Styria and Bo-

hemia soon spread over a large portion of the empire and the adjacent countries, and has gone down in history as the Thirty Years' War. It began to appear that the Protestant faith would be forever stamped out of Europe under the leadership of the imperial forces by Wallenstein, when Gustavus Adolphus of Sweden unexpectedly crossed into Germany, meeting the imperial forces at Lützen on Nov. 6, 1632, and there dealt a complete defeat to the designs of Ferdinand. The ability demonstrated by the Swedish generals was more than equal to that of the Austrian leaders. Shortly after the Battle of Lützen, Ferdinand caused Wallenstein to be assassinated for the reason that he feared the rising power of that general. His reign was marked with many disastrous battles, while armies organized under his imperial command left nothing but ruin and desolation in their track.

FERDINAND III., sovereign of the Holy Roman Empire, born in Grätz, Austria, July 20, 1608; died April 2, 1657. He was the son of Ferdinand II. and succeeded him to the throne in 1637. His disposition was milder than that possessed by the father, and he showed less fanaticism in his support of the ecclesiastical party. Religious toleration was granted in most parts of the empire, and the German nation began to recover from the fearful ravages of the great wars that had demoralized trade and destroyed more than half the population. Concessions were granted in the interest of peace to independent princes, while France obtained part of Alsace and Lorraine and Sweden secured Western Pomerania. The German Empire practically ceased to exist at the death of Ferdinand III., and was not reëstablished until the new German Empire rose under William I., after the close of the Franco-Prussian War in 1870-71.

FERDINAND I., surnamed the Great, first sovereign of independent Castile, born in the year 1000; died Dec. 27, 1065. He succeeded to the throne in 1035. In 1053 he defeated his brother, Garcia III., King of Navarre, who had attacked his army, and extended his dominions by annexing a number of provinces previously governed by the defeated sovereign. He entered upon a plan early in his reign to suppress the Moors, for which purpose he extended the Christian frontier from the Douro to the Mondego, and reduced to vassals the emirs of Saragossa, Toledo, and Seville. Shortly after he claimed the title of Emperor of Spain, though a decision rendered at the conference held in Toulouse conceded him only the portions conquered from the Moors.

FERDINAND II., King of Leon, younger son of Alfonso VIII., ascended the throne in 1157; died in 1188. His reign of 31 years is obscure, but is marked most distinctly by the successes over the Moors and the incorporation of the noted military order of Alcantara under sanction of Pope Alexander III. in 1177. His death occurred at Benavente, and his son, Alfonso IX., succeeded him.

FERDINAND III., King of Castile, known as Saint Ferdinand, son of Alfonso IX., born in 1199. Henry I. of Castile died without issue in 1217, and Ferdinand III. was proclaimed king in 1230, immediately succeeding his father. The events for which his reign is most distinguished include the vigorous wars waged against the Moors. His most celebrated victories were those at Ubeda in 1234, at Cordova in 1236, and at Seville in 1248. In the latter part of his reign he planned an expedition to Africa, but died before his hopes could be realized, his death occurring at Seville on May 30, 1252. Pope Clement IX. canonized him in 1671 on account of his zeal in the Christian cause. The Spanish calendar designates his fast-day on May 30.

FERDINAND IV., King of Castile and Leon, born in Seville in 1285, suceeded his father, Sancho IV., in 1295. His reign of seventeen years became renowned by several successful wars against the Moors. His death occurred at Jaén while on a campaign, Sept. 7, 1312.

FERDINAND V., King of Castile, II. of Aragon, III. of Naples, and II. of Sicily, born in Aragon, Spain, March 10, 1452; died Jan. 23, 1516. He was the son of John II. of Navarre and Aragon, was recognized heir apparent to the crown on the death of his brother Carlos in 1461, and was associated with his father in the government of Aragon as early as 1468. About the same time he was declared King of Sicily by his father. In October, 1469, he married Isabella, the sister and heir of Henry IV. of Castile, at Valladolid. When Henry IV. died in 1474, Ferdinand and Isabella were recognized joint sovereigns of Castile. In 1478 he reorganized the Inquisition as a means to further religious ends. His zealous support of the Catholic princes in Spain caused the expulsion of 160,000 Jews and the termination of Moorish power in Spain in the year 1492. Soon after he added Navarre and Naples to his possessions and formed the entire Iberian peninsula into one state, with the exception of Portugal. The most interesting event connected with his reign is the discovery of America by Columbus, though the honor of granting imperial support belongs wholly to Isabella. Ferdinand V. was a crafty and ambitious ruler, but in character he lacked both stability and veracity.

FERDINAND VI., King of Spain, son of Philip V., born in Madrid, Sept. 23, 1713; died Aug. 10, 1759. He ascended the throne in 1746, and entered at once upon a vigorous attempt to conclude the war with England that had waged since 1739, which resulted in the Treaty of Aix-la-Chapelle in 1748. Dying without issue, he was succeeded by his half-brother, Charles III.

FERDINAND VII., King of Spain, born at San Ildefonso, Oct. 13, 1784; died Sept. 29, 1833. He was the eldest son of Charles IV. and of Maria Louisa of Parma, became Prince of Asturias in 1788, and, when his father was forced to abdicate on account of a popular rising in March, 1808, he ascended the throne. A month later Napoleon compelled him to abdicate and conferred the sovereignty upon Joseph, brother of Napoleon. When the imperial army of France was defeated at Vittoria on June 21, 1813, by Wellington, Ferdinand was permitted to reënter Spain and occupy the throne on the condition that he would expel the English from the peninsula. The arbitrary reign of Ferdinand caused an insurrection in 1820, but an army was sent to aid him by Louis XVIII. of France, by which his authority again became supreme. The act of 1713, passed during the reign of Philip V., excluded women from the throne of Spain, but this Ferdinand set aside to make place for his daughter, Isabella, and thereby excluded his brother, Don Carlos. The reign of Ferdinand was generally unsuccessful, being marked by numerous insurrections, the loss of most of the colonial territory in America, and a consequent widespread interference with commercial and manufacturing enterprises in Spain.

FERDINAND I., King of Naples, son of Alfonso V. of Aragon, born in 1424; died Jan. 25, 1494. Although he succeeded to the throne in 1458, he was not recognized by Pope Calixtus III., who championed the cause of John of Anjou. The latter defeated him July 7, 1460, but, when Pius II. recognized Ferdinand, he secured a victory over John of Anjou, Aug. 18, 1462, thereby attaining supremacy.

FERDINAND IV., King of Naples, born in Naples, Jan. 12, 1751; died Jan. 4, 1825. His father ascended the throne of Spain in 1759, and Ferdinand became his successor on the throne of Naples under a regency. He married Maria Carolina, daughter of Empress Maria Theresa, in 1768.

FERDINAND I., King of Rumania, born at Sigmaringen, Prussia, Aug. 24, 1865. His father, Leopold of Hohenzollern, resigned in his favor as heir to the crown of Rumania in 1888. He married Marie, daughter of the Duke of Saxe-Coburg and Gotha, in 1893, and in 1914 succeeded his uncle, Charles I. He died July 20, 1927.

FERDINAND I., Czar of Bulgaria, Duke of Saxe, born in Vienna, Austria, Feb. 26, 1861. He was chosen Prince of Bulgaria on July 17, 1887, by the grand national assembly at Tirnova, subscribed to the constitution, and on Aug. 14, 1887, assumed the reins of government under the title of Ferdinand I., although his election was not confirmed by the Sultan of Turkey, or by the treaty powers. On April 8, 1893, he married Marie Louise, daughter of the Duke of Parma of the house of Bourbon. Shortly after he joined the Greek Church, which course was taken as a step toward securing the confidence of the Russian government, and his policy since has been marked largely by influences exercised through Muscovite diplomats, though in the main he has been eminently successful. In 1908, Bulgaria became independent and he assumed the title of Czar. The defeat of his armies compelled him to abdicate in 1918.

FERGUS FALLS (fĕr'gŭs fąls), a city in Minnesota, county seat of Ottertail County, on the Otter Tail River, 186 miles northwest of Minneapolis. It is on the Northern Pacific and the Great Northern railroads. The noteworthy buildings include the county courthouse, the high school, the public library, the Park Region Lutheran College, and a State hospital for the insane. It has manufactures of flour, ironware, clothing, cigars, and machinery. The Otter Tail River supplies an abundance of water power, by which various manufactories, an electric light plant, and several mills are operated. It was settled about 1861 and incorporated as a city in 1863. Population, 1920, 7,581.

FERGUSON (fĕr'gŭ-sŭn), **James**, astronomer, born near Keith, Scotland, in 1710; died in London, Nov. 16, 1776. He descended from poor parents, studied astronomy while a boy tending sheep, and later utilized his careful observations for constructing a celestial globe and astronomical apparatus. Subsequently he took a course of training at Edinburgh, where he became skilled in mathematics and drawing, and later supported himself by making portraits. Removing to London in 1743, he engaged in painting, and gave a course of lectures on experimental astronomy. George III., then Prince of Wales, was attracted to his lectures, and afterward gave him a pension of $250 a year. Among his principal works are "Lectures on Mechanics," "Astronomy Explained upon Newton's Principles," and "Select Mechanical Exercises."

FERMENTATION (fĕr-mĕn-tā'shŭn), a change which takes place in most animal and vegetable substances when they are exposed to air and moisture at ordinary temperatures. It is a chemical decomposition of an organic compound induced by chemical agents or by living organisms. In the former, called *unorganized* or *chemical* ferments, the enzyme causes a structural change without losing its identity, as in digestion; while in the latter, called *organized* ferments, the action is due to the growth of the ferment, as in the formation of acetic acid from alcohol by the action of the vinegar plant. The various organisms which produce fermentation apparently derive their nourishment from the original compound, and yield products that are poisonous to the ferment. It is for this reason that chemical decomposition ceases when fermentation products are in excess, or the nutriment is exhausted. It is arrested by certain substances, such as salt and alcohol, called *antiseptics*, as well as by heat and cold.

Several kinds of fermentation are recognized, the name depending upon the specific product obtained. In *alcoholic* fermentation the sugar contained in liquids is converted into carbonic acid, alcohol, and glycerin; in *acetic*, the spirituous liquors become acid and produce acetic acid; and in *putrid* fermentation, organic substances are altered in various ways, the alteration depending upon the nature of the substance, and poisonous gases are generally set free. Besides these are *ammoniacal*, yielding ammonia; *benzoic*, yielding benzoic acid; *amylic*, yielding amylic alcohol; *viscous*, yielding a gummy mass; *lactic*, yielding lactic acid; and *butyric*, yielding butyric acid.

The various kinds of fermentation may be effected at different degrees of temperature, varying from about 24° to 104° Fahr. In digestion the ferments of the pancreas act on fibrin at 90°. Viscous fermentation, in which wine is made thick and viscous so it forms threads when poured, occurs at a temperature of from 60° to 104°. Alcoholic fermentation under certain condition takes place readily at 24° to 30°. The ferments employed to excite fermentation are mostly organic, though there are many of an inorganic nature. Among the most common fermented liquors containing alcohol and used as beverages are wine, made from the juice of grapes; mead, from honey; cider, from apples; ale or beer, from an infusion of malt; and chica, from maize. The last mentioned is made in large quantities in South America. See **Beer**.

FERNANDEZ (fĕr-năn'dĕz), **Juan,** navigator, born in Spain in 1536; died in 1602. He became a navigator at an early age and for forty years promoted explorations and settlements in South America. In 1562 he discovered the island of Fernando de Noronha, a small island in the South Atlantic Ocean, about 200 miles northeast of Cape Saint Roque. Enchanted with the beauty of this island, he established a colony there, but it proved a failure. In 1590 he settled in the mountains of Chile, where he remained until his death.

FERNANDINA (fĕr-năn-dē'nà), a city of Florida, county seat of Nassau County, on Amelia Island, 35 miles northeast of Jacksonville. It is on the Seaboard Air Line Railroad and has a good harbor on the Amelia River, which separates the island from the continent. The city has a large trade, both inland and foreign, in lumber, cotton, phosphates, and merchandise. A fine shell road extends to Amelia Beach. Cumberland Island, located near the city, was the home of Gen. Nathaniel Greene and is the burial place of Light Horse Harry Lee. Fernandina was settled by the Spaniards in 1632, and was incorporated in 1859. Population, 1925, 3,078.

FERNANDO PO (fĕr-năn'dō pō'), an island belonging to Spain, located in the Bight of Biafra, about 20 miles off the west coast of Africa. It is 42 miles long and 20 miles wide, and has an area of 768 square miles. The surface is mountainous, but the soil is fertile and well watered. Clarence Peak, the highest summit, has an altitude of 11,025 feet. The climate is hot and unhealthful. Among the chief products are rice, bananas, corn, yams, and live stock. The Portuguese discovered the island in 1471, but it became a part of Spain in 1787. Santa Isabel, the chief town, has a population of 1,500. The island is inhabited chiefly by native Negroes and Portuguese. Population, 1922, 21,346.

FERNS, a class of leafy but flowerless plants, springing from a rhizome, which creeps on the surface of the ground, or rises in the air like the trunk of a tree. This trunk does not taper, but is of equal diameter at both ends. The reproductive organs consist of spore cases and are attached to the veins at the under surface of the leaves, or at their margins. Most ferns are comparatively small, while some tree ferns

FERN-TREE. *a.* SPORE CASES.

reach sixty feet in height. Seventy-five genera and about 4,000 species are known. Some ferns yield products useful for food, while other species contain properties which are of value in medicine for expelling tapeworms. The fronds of ferns, or their impressions, are frequently met with in a good state of preservation as early as the middle of the Silurian period.

FERRARA (fĕr-rā'rà), a city in Italy, capital of a province of the same name, situated on the Po River, about 26 miles northeast of Bologna. The site is low and unhealthful, but the streets are broad and well paved. It is an ancient city and has many towers and bastions. Among the most beautiful of ancient buildings are the old ducal palace and several cathedrals. A number of fine monuments are in the public places, one being dedicated to Savonarola, who was born here. The public library contains 100,000 volumes. It has modern municipal facilities, while railroad and telephone connections are well established. Among the manufactures are pottery, clothing, utensils, and machinery. Ferrara was an important city in ancient times,

when it had 100,000 inhabitants, and its university dates from 1264. It was long held as a fief of the popes, came under the rule of the house of Este, and in 1797 was united with the Cisalpine Republic. In 1814 it was restored to the popes, but has been a part of Italy since 1859. Population, 1921, 102,845.

FERRET (fĕr′rĕt), a carnivorous animal of the weasel family, but closely allied to the polecat. In form and size it approaches the common mink. It is native to Africa and cannot endure excessive cold. The representative species are about fourteen inches long and of a yellowish color. Ferrets are much used, both in America and Europe, for destroying rats and

FERRET.

for driving rabbits out of their places of seclusion. Several species are carefully bred in captivity, in which state they subsist on bread, raw meat, and milk. The *black-footed ferret,* found in the western plains of North America, is a species of the weasel. It is about two feet long, has a pale brown color, and the feet and tip of the tail are black. This animal is seen in the towns of prairie dogs, upon which it feeds.

FERRIS, George Washington Gale, engineer, born in Galesburg, Ill., in 1858; died in 1896. He was taken to California by his parents at an early age, where he received his elementary education, and in 1881 graduated at Troy, N. Y., from the Rensselaer Polytechnic Institute. Shortly after he located in business at Pittsburg, Pa., engaged in extensive construction work, and, when a special structure was desired for the Columbian Exposition that should rival the Eiffel Tower, he began to prepare the necessary specifications. This resulted in plans for the celebrated Ferris Wheel, which attracted universal admiration at Chicago in 1893, and at Saint Louis in 1904, and was a source of much profit to the promulgators of the enterprise.

FERRIS WHEEL, an immense structure designed and invented by G. W. G. Ferris, and constructed in Chicago in 1893 as a popular feature in the Midway Plaisance at the Columbian Exposition. This great wheel, the largest ever built, contained two wheels of the same size that were securely connected by struts and rods. An axle thirty-one inches in diameter and forty-five feet long was at the center, while the spokes were iron rods two and a half inches in diameter, placed in pairs thirteen feet apart at the crown connection. Thirty-six cars were hung on the periphery, each having a convenient seating capacity for forty passengers. The weight of the wheel and passengers was 1,200 tons, this immense burden being supported by substantial mechanical devices and a solid concrete foundation. The circumference of the wheel was 825 feet; diameter, 250 feet; and elevation above the ground, fifteen feet, making a total height of 265 feet. It was lighted throughout the exposition season by 3,000 electric lights. The total cost of construction aggregated $300,000, while the number of passengers carried during the period of operation was 1,454,013. It was taken down at the close of the exposition and erected near Lincoln Park, Chicago, and in 1904 was removed to the exposition in Saint Louis.

FERROL (fĕr-rôl′), a city of Spain, in the province of Coruña, on the Bay of Betanzos, twelve miles northeast of Coruña. It has a fine harbor and is strongly fortified. The manufactures include hardware, leather, chocolate, cutlery, and firearms. Among the chief buildings are those of the government, a number of churches, and several schools. The streets are wide and regular and are beautified by several squares and promenades. Electric lights and street railways are among the public utilities. Ferrol was made a naval station by Charles III., and still has the largest shipbuilding interests in Spain. The French captured it in 1809 and in 1823. Population, 1922, 26,875.

FERRY (fĕr′rȳ), a passage by boat across a small body or stream of water. Ferryboats ply back and forth across water to carry passengers, horses, vehicles, or any other form of traffic. Any mode of power may be used to propel the boat, which is usually fastened to a cable stretched from bank to bank. Sometimes a pulley is placed over the cable and the action of the water in a running stream carries it across. Large ferries are propelled by steam and furnish transportation for several thousand passengers, as those operated in New York City across the Hudson and the East rivers. In some cases entire trains are transported by steam ferry, as across Hampton Roads, the Columbia River, and the Straits of Mackinac.

FERRY, Jules François Camille, statesman, born in Saint-Dié, France, April 5, 1832; died

March 7, 1893. He was admitted to the Paris bar in 1854, and soon afterward identified himself with the opponents of the empire. In 1865 he secured an election to the legislature, opposed the war with Prussia in that body, and assisted in suppressing the Commune in 1870. After the establishment of the republic, he became minister to Athens and in 1879 was made minister of public instruction. When the ministry dissolved in 1880, it devolved upon him to form a cabinet, which soon after adopted a policy of colonial expansion, but he resigned in 1881 as a result of dissensions regarding the military contentions in Tunis. In 1883 he was again made premier, but his ministry was overthrown in 1884 by an adverse vote in relation to the war with China. The defeat of the French troops in Tonquin made him unpopular, and he withdrew into retirement until 1893, when he was recalled to public life on account of the Panama Canal excitement. His death occurred shortly after his election to the presidency of the senate.

FERTILIZERS (fĕr'tĭ-lī-zĕrz), the general name of substances that are used to enrich the soil and promote the growth of plants. It is common to distinguish between homemade and commercial fertilizers, the former being known as *manure* and the latter as *fertilizers*. In a restricted sense the latter applies only to the materials that pass through some process of manufacture before being utilized in farming or gardening. They include such inorganic materials as nitrate of soda, sulphate and chloride of potash, and variously prepared forms of sulphatic rock. Another class embraces such organic substances as guano, bone dust, and the refuse from slaughterhouses. Desiccated and ground sheep manure is a kind of commercial fertilizer.

Stable manures are usually spread on the ground and plowed under, while commercial fertilizers are drilled into the soil in connection with wheat, corn, rye, and other grains, and in this way the plant food comes in direct contact with the roots of the growing plants. The manufacture of commercial fertilizers is regulated by law in many states and provinces, requiring in most countries supervision under the state or government, and the different classes are tested and graduated on the basis of their utility as plant food. This is quite necessary, since the agricultural classes otherwise would be unprotected against the use of worthless or harmful materials. See **Manure.**

FESSENDEN (fĕs'ẹn-dẹn), **William Pitt,** statesman, born in Boscawen, N. H., Oct. 16, 1806; died at Portland, Me., Sept. 8, 1869. After securing a law education, he entered the practice in Maine and in 1832 was elected as a Whig to the Legislature, where he served a number of terms. The Free-soil democrats and Whigs elected him to the United States Senate in 1854, and he served in that body two terms. He became a prominent factor in organizing the Republican party, opposed the Kansas-Nebraska bill, and attended the peace convention in 1861. In 1864 he succeeded Salmon P. Chase as Secretary of the Treasury, which he resigned the following year to again enter the Senate During his last term he was chairman of the joint committee on reconstruction and of the finance committee. Fessenden opposed the impeachment of Andrew Johnson, and was one of the seven Republican senators who voted against conviction after the trial by the Senate.

FESTIVALS (fĕs'tĭ-vạlz), or **Feasts,** a period of one or more days consecrated to commemorate some important event or the observance of some religious rite. Festivals were held by most ancient nations and have continued to be observed throughout the modern centuries, though in a modified form. At the time Homer wrote the "Iliad" it was customary among the Greeks to keep two principal festivals—those of the harvest and the vintage—in which the deities were borne through the assemblages, animals were sacrificed, and the sounds of music rent the air. The six sacred festivals of the Jews are enumerated in Leviticus xxiii. The ancient Greeks celebrated the festivals of Dionysia and Eleusinia and the Pythian, Olympic, Nemean, and Isthmian games, the four last mentioned constituting their great national games. Many festivals were celebrated in ancient Rome, but the Cerealia, Lupercalia, and Saturnalia constituted the more important. Many of the civil festivals of the Romans and Greeks were similar in that they constituted warlike games and exercises.

The festivals kept by the Christians give distinct reference to Christ and other personages held important in the history of the church. Formerly each festival was known as a *holy day,* hence the name *holiday.* The observance of Sunday is of most frequent occurrence. Other festivals designated in the Christian calendar have reference to events in the life of Christ, such as Christmas, Annunciation, Purification, Easter, Ascension, Corpus Christi, Epiphany, Transfiguration, and Trinity. Numerous festivals are set apart to commemorate saints, apostles, and angels, though in most of the churches every day of the year is dedicated to some personage or event. The term *holiday* at present has particular reference to the days set apart by the government to commemorate some important personage or event. See **Holiday.**

FESTUS, Porcius, the Roman governor of Judaea under Nero in 61-62 A. D., who succeeded Felix. The apostle Paul appeared before him as a prisoner, and, after hearing his remarkable plea, Festus manifested a disposition to set him free, but Paul appealed to Caesar and was accordingly sent to Rome.

FETICH (fē'tĭsh), or **Fetish,** a word introduced by Charles de Brosses (1709-1777) in

1760 in his publication, "Du Culte des Dieux Fetiches." It was derived from the Portuguese word *feitiço,* meaning *magic,* a term which expresses the idea held by the Portuguese concerning the religion of the natives found in Western Africa. The name was applied by Comte in a general way to the primitive theories of religion, but Sir John Lubbock assigns it as the second stage in the evolution of religious thought, rather than as a form of religion. He takes this view for the reason that the idea of worship is not necessarily involved, since the Negro believes that his deities can be compelled to comply with his desires by means of his fetich. Fetichism is a form of superstition which supposes the earth, feathers, trees, mountains, plants, serpents, and other animate or inanimate objects to have a spirit, and that the person having possession of the object can utilize that spirit as a servant. If the spirit does not attend to all the possessor requests, he beats the object as if to inflict pain as punishment. The most extensive forms of fetich worship prevail in Guinea and other portions of Western Africa.

FEUDAL SYSTEM (fū'dạl), an economic system or condition in force throughout Europe for many centuries. It was distinguished by the political and social ranks which were based on the tenure of feuds and fiefs, given as compensation for military service rendered by chiefs. Under these owners the land was sublet by allotment to their subordinates and vassals in consideration of like service to be rendered. According to the feudal system, the king was the owner of all the land in his dominion, while noblemen held certain tracts under grants from him at his pleasure, but usually on condition of military service. When the Teutonic conquerors of the Roman Empire acquired paramount power, the feudal system made it possible for them to hold possession under the influence of noblemen, who were personally benefited. It had spread over all of France and Germany by the time William the Conqueror led his expedition into England, and soon after all the land was seized and a feudal system was established. It prevailed in England in a widespread form until the restoration of Charles II. However, traces of it are still abundant, but the conditions are greatly modified.

The people of England, who had acquired absolute possession under the Angles and Saxons, universally opposed the establishment of feudal ownership. Here the lands were said to be *allodial* to distinguish them from the *feudal* lands. Later both classes of ownership were recognized, the allodial estates being held by the noble and ordinary freemen and the feudal by those who were bound to serve some superior lord. The latter system possessed some advantage in that it furnished greater security of life and property, hence it came to predominate as a matter of necessity. Even the minor nobles who owned estates voluntarily placed themselves for protection under some more powerful earl or duke, which gradually gave rise to the powerful principalities of Germany and the whole continent.

The feudal system began to crumble with the rise of learning. Other causes of its decline include the spread of civilization, a wider knowledge of the rights of citizens, the rise of cities, and a change in the modes of warfare. Traces more or less prominent are still found in some countries, such as landowners holding title only as tenants from lords or titled nobles. On the banks of the Rhine and in many regions of Germanic and Romanic countries are remains of the system, such as castles formerly occupied by feudal barons and numerous villages in which dependents were grouped for religious worship and educational instruction.

FEUERBACH (foi'ĕr-bäk), **Ludwig Andreas,** philosopher, son of Paul J. A. Feuerbach, born in Landshut, Germany, July 28, 1804; died Sept. 13, 1872. He first studied at Heidelberg and later at Berlin under Hegel. In 1828 he secured a professorship in the University of Erlangen, but after a few years devoted all his time to literary work. His teachings contend against immorality, and hold that truth can be ascertained only by the senses coming in touch with things. Among his best known works are "The Essence of Religion," "Thoughts Regarding Life and Death," "Godhead, Freedom and Immortality," and "The Essence of Christianity." The last-mentioned book was translated by George Eliot in 1854.

FEUERBACH, Paul Johann Anselm, distinguished criminal jurist, born in Jena, Germany, Nov. 13, 1775; died May 25, 1833. He graduated from the law course of the University of Jena, became devoted to the practice of law, and later accepted the chair of jurisprudence at Jena and subsequently at Kiel. In 1804 he was made professor of criminal law in the University of Landshut, and soon after drew a criminal code for Bavaria. He became second president of the court of appeals at Bamberg in 1814, and three years later was made first president of the appeal court at Anspach. Among his publications are "On the Crime of High Treason," "Remarkable Criminal Trials," and "Contributions to the Art of Law Making."

FEUILLET (fē-yā'), **Octave,** novelist and dramatist, born at Saint Lô, France, Aug. 11, 1821; died Dec. 28, 1890. He studied at Paris and for some time was a literary assistant to Dumas. Later he became a purveyor of novels and plays which in his judgment would prove agreeable reading, and in the meantime contributed to various newspapers and periodicals. In 1862 he was elected to a professorship in the French Academy. Among his writings are "A Marriage in High Life," "The Temptation," "Dalila," "The Sphinx," and "The Romance of a Poor Young Man."

FEVER (fē'vĕr), a disease or group of diseases characterized by an accelerated pulse and increased heat of the skin. Fevers usually commence with chills, loss of appetite, feeling of lassitude, pains in the back and limbs and nausea. They are classified into *continued* fevers, such as typhus or typhoid; *intermittent,* occurring at regular periods; *remittent,* such as yellow fever; and *eruptive* fevers, as smallpox, measles, and scarlet fever. Fevers are commonly named from the ailments with which they are associated, as *lung fever,* which is connected with inflammation of the lungs. The temperature in a low fever usually ranges from 100° to 102°, which is not considered much above the normal, but in high fevers it frequently reaches 103° or even 105°. When the temperature excels 105°, it is considered dangerous and may prove fatal.

FEVERFEW, the common name of a perennial plant native to America and Europe, found near hedges and in waste places. It is allied to the wild chamomile, but has flat leaves and smaller flowers. The stem has many branches, is about two feet high, and has a strong aromatic smell. It was so named from its use as a medicine in treating ague and fever and is still used as a tonic and stimulant. A double flowering species is cultivated in gardens and a related plant yields the Persian insect powder.

FEZ, the largest city in Morocco, capital of the province of Fez and the principal seat of government in Morocco. It is situated in a valley of the Atlas Mountains about 100 miles east of the Atlantic and 85 south of the Mediterranean. The valley is fertile and is drained by the Fez River, on which the city is located. Ancient walls surround the principal part and the city consists largely of inconvenient houses. It has angular streets and extremely poor sanitary regulations. Among the public buildings are numerous mosques, one of which is the largest in Northern Africa. The palace of the Sultan is an ancient structure, but it is in a state of good preservation. Many of the edifices have fine porticos and are beautified by trees and gardens. The university, founded in 1859, is important as a seat of Moorish learning. It has a large library, botanical gardens, and about 850 students. Among the municipal utilities are a number of public parks and some modern facilities, such as telephones, sewerage, and tramways.

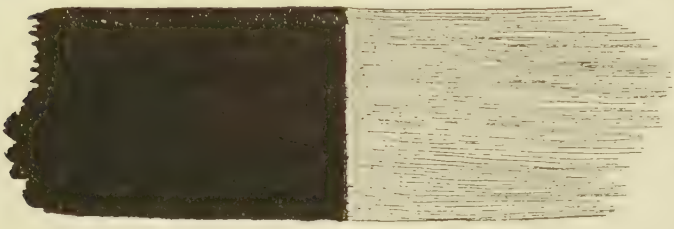
The commercial importance of Fez dates from times far remote, although domestic commerce is still carried on largely by caravans from and to the interior. The trade with Europe is extensive, the exports consisting largely of grain, live stock, fruit, and local manufactures. Among the manufactured products are leather, silk, woolen cloaks, fez caps, handkerchiefs, pottery, and utensils. Fez was founded in 793 A. D., by Edris II. It was the capital of an independent state from 1202 until 1548, during which period it attained widespread prosperity, and was long famous as a seat of Arabian learning. The inhabitants consist mostly of Moors, Arabs, Jews, Berbers, and Negroes. Population, 1922, 141,385.

FEZ, a kind of brimless hat made of fine red wool, so named from Fez, Morocco, where it was first manufactured. It fits the head closely, has a blue or black tassel upon the crown, and is worn extensively by the Turks. The name *tarbush* is applied to it in Africa.

FEZZAN (fĕz-zän'), a state in Northern Africa, situated south of Tripoli and attached to it for governmental purposes. The length from east to west is 380 miles; width, 300 miles; and area, 110,000 square miles. The surface is hilly and is traversed by the Jebel-es-Soda or Black Mountains, which trend east and west 170 miles and are not elevated above 3,000 feet. Much of the interior is made up of small oases, but the northwestern part is a waterless plateau and the southern section is a desert. It is largely unproductive, owing to an excessively hot climate and the absence of sufficient rainfall. The domestic animals consist largely of goats, sheep, camels, and cattle. Among the chief agricultural products are cotton, barley, wheat, millet, tobacco, vegetables, and fruits. The government is administered by a lieutenant governor under the pashalic of Tripoli, hence it is a dependency of Turkey. Murzuk is the principal town, having a population of 7,250. The inhabitants consist chiefly of Tuaregs, Moors, Arabs, Berbers, and Negroes. Little advancement has been made in the industries and arts, many of the people being unable to read and write. Arabic is the chief language and Mohammedanism of the Sunnite sect is the prevailing religion. The Romans conquered the region in 19 B. C., when it was known as Phazania, and the people became Christians in the 6th century. In the 7th century it was conquered by the Arabs. Population, 1922, 72,380.

FIBER (fī'bĕr), or **Fibre,** a small thread, string, or filament of which the tissues of animals and plants are constituted. Asbestos is the only mineral fiber known. The utility of fibers in the arts and manufactures depends upon the length, structure, strength, and ability to retain colors in dyeing. Among the more common animal fibers in use are wool, silk, and furs (q. v.). Vegetable fibers are employed extensively in the arts and are obtained from different parts of a large number of useful plants. Cotton fibers surround the seed of the cotton plant. Jute, hemp, and flax fibers are obtained from the bark of plants. The husk of the cocoanut and the leaves of various palms are used for making rope and matting. In recent years the fiber of the sisal hemp has come into extensive use for binding twine and rope. Ramie, or China grass, corn husks, Esparto grass, broom corn, Spanish moss, and vegetable sponge furnish fibers for manufacturing purposes. A

majority of the finer textile fibers are obtained in the Temperate zones, but the larger number of fibers come from the warmer countries. See **Cotton, Linen, Paper.**

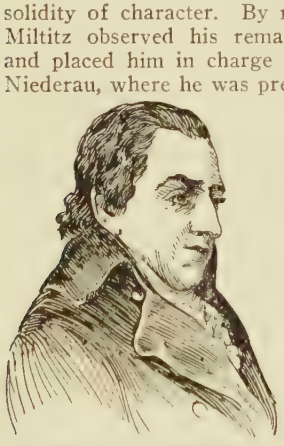


FIBER OF HEMP.

The light part shows the fibers after the pulp has been scraped off by a knife or stripping machine.

FIBRIN (fī'brĭn), a white proteid compound obtained when blood is coagulated, as by stirring fresh blood with a bundle of twigs. The fibrin, adhering in fibrous layers, is washed with water to remove the coloring matter. It is insoluble in water, but dissolves in an aqueous solution of nitrate of potassium, when heated to 40° Fahr. Normal human blood contains 2.55 per cent. of fibrin. Vegetable fibrin is a nitrogenous substance resembling animal fibrin, and is separated from the seeds of cereals and other plants.

FICHTE (fĭk'tę), **Johann Gottlieb,** famous philosopher, born in Rammenau, Germany, May 19, 1762; died in Berlin, Jan. 27, 1814. He descended from a family noted for piety and solidity of character. By mere accident Baron Miltitz observed his remarkable mental vigor and placed him in charge of Pastor Krebel at Niederau, where he was prepared for higher instruction. He entered the University of Jena as a student of theology and later took a course in philosophy. In 1790 he settled in Leipzig, where he married Johanna Maria Rahn, and the following year met Kant, which proved the most important event of his life. He soon attracted attention of the latter and won his close friendship. Subsequently he was elected to the chair of philosophy at Jena, later at Erlangen, and still later became rector of the University at Berlin. Under an appointment of the king, he prepared a constitution for the latter institution, and in the line of duty became associated with such men as Schleiermacher, Humboldt, DeWette, Neander, and Schlegel. The latter part of his life was devoted largely to lectures, and, when the vast movements for German national independence became spontaneous, he contributed support by making many fervid addresses.



JOHANN G FICHTE.

The achievements of Fichte did not lead to the establishment of a distinct school of philosophy, but his teachings and writings have influenced the educational aspect of all civilized peoples. He taught that each individual creates a *world* for himself, in which his life and activities are paramount, but, as a matter of convenience, we are inclined to accept as true the same phenomena which are observed by the senses of others. God, being everywhere manifest, is the finite personality. He considered selfishness the root of all evil, since it limits the *world* of each individual and hinders the free activity of the *self.* Among his celebrated works are "Critique of Revelation," "The Nature of the Scholar," "The Vocation of Man," "The Way to a Blessed Life," "Characteristics of the Present Age," "The Vocation of the Scholar," "Our Belief in a Divine Government of the Universe," and "Introduction to the Theory of Science." Thomas Carlyle and a number of other writers translated from Fichte. Several of his works on education are considered excellent authority and are quoted frequently by educators.

FICHTELGEBIRGE (fĭk'tęl-gę-bêr-gę), a mountain range of Germany, on the northern frontier of Bavaria, about midway between the Bohmer Wald and the Erzgebirge. It has a general elevation of 3,000 feet, but Schneeberg, the highest peak, is 3,415 feet above the sea. This range of mountains separates the affluents of the German Ocean and the Black Sea, being the source of the Naab, the Main, the Saale, and the Eger. Much of the surface is covered with firs and pine. Copper, lead, and iron ores are mined extensively.

FIELD (fēld), **Cyrus West,** merchant and scientist, born in Stockbridge, Mass., Nov. 30, 1819; died in New York City, July 12, 1892. After receiving an education in the public schools, he went to New York City, where he secured a position as clerk in a dry goods store at a small salary. In 1840 he established himself as a paper manufacturer. He retired from business in 1853, traveled in South America, and, on his return the following year, began to study oceanic telegraphs. After numerous unsuccessful attempts, he finally succeeded in securing a charter for a telegraph line from New York City to Europe by way of Newfoundland. He devoted thirteen years to this enterprise, in enlisting interest and having the work done, and in the meantime crossed the Atlantic fifty times.

The telegraph line to Newfoundland was the first to be completed, receiving his personal

supervision, and in 1857-58 he accompanied the expedition to lay the cable in the Atlantic Ocean from Newfoundland to Europe. The enterprise was consummated with entire satisfaction in July, 1866. In laying the cable, the *Great Eastern,* then the largest vessel afloat, was used. Congress voted him a gold medal for his achievement and he received various decorations from several European countries. Communication between the two continents has never been interrupted since this line was completed. Later he promoted the construction of the elevated railroads in New York City. He erected a monument to the memory of Major John Andre at Tarrytown, N. Y., but it was subsequently destroyed by people who were prejudiced against Major Andre. His faithful lifework was recognized by the civilized world, but financial embarrassments embittered his closing years.

FIELD, David Dudley, jurist, born at Haddam, Conn., Feb. 13, 1805; died April 13, 1894. He studied at Williams College, was permitted to the bar in 1828, and took up the practice of law in New York City. In 1847 he was made a commissioner on practice and pleadings, and the Legislature enacted as a law the work reported by the commissioner, entitled "Codes of Civil and Criminal Procedure." Later he was made the head of a commission to prepare a political code, a civil code, and a penal code, and these were completed in 1865. His greatest work is entitled "Outlines of an International Code," which was translated into Chinese and several European languages, and was the basis of reforms in codifying the laws of several nations. In 1876 he was elected to Congress as a Democrat. Among his later publications are "The Electoral Votes of 1876" and "Speeches and Arguments Before the Supreme Court of the United States."

FIELD, Eugene, journalist and poet, born in Saint Louis, Mo., Sept. 3, 1850; died in Chicago, Nov. 4, 1895. He entered Williams College in 1868 and later attended Knox College, Galesburg, Ill. His higher education was secured at the State University of Missouri, and, after traveling abroad, he engaged in newspaper work in 1873 with the Saint Louis *Journal.* Later he held editorial positions on papers published at Saint Joseph, Saint Louis, Kansas City, Denver, and Chicago. In connection with the Chicago *Morning News,* now the *Record-Herald,* appeared his best journalistic work, in a column called *Sharps and Flats.* As a platform reader of his own productions he stood in high repute, and while preparing for a trip of this kind he died quite suddenly. Eugene Field, as a joker, was practical, bold, and showed a spirit of enjoyment that made him universally popular. Among his productions for children are "Little Boy Blue," "Seein' Things," "Jes' 'Fore Christmas," and "Wynken, Blynken and Nod." These writings caused him to be styled the "Poet Laureate of the Children." His best known published works include "The Second Book of Verse," "Love Songs of Childhood," "Echoes from the Sabine Farm," "A Little Book of Western Verse," "The Gradual Rise of Literature in Chicago," and "A Book of Profitable Tales." The most delicately humorous essays of Field are contained in "The Love Affairs of a Bibliomaniac," and his best verses for children are in "With Trumpet and Drum."

FIELD, Kate, actress and journalist, born in Saint Louis, Mo., in 1840; died May 19, 1896. She studied at Boston and in Europe, and while abroad corresponded to various American newspapers and magazines. In 1874 she played as *Peg Woffington* at Booth's Theater in New York City and followed a stage life for some time. Subsequently she lectured and published a weekly under the name of *Kate Field's Washington.* Her writings include "Ten Days in Spain," "History of Bell's Telephone," "Agnes Ristori: A Biography," and "Penned Photographs of Charles Dickens's Readings."

FIELD, Marshall, business man, born in Conway, Mass., in 1835; died Jan. 16, 1906. At an early age he engaged as clerk in Pittsfield, Mass., and in 1856 went to Chicago as clerk in a wholesale dry goods establishment, in which he became partner in 1860. In 1865 he joined the firm of Field, Palmer & Leiter, from which Palmer retired in 1867 and I. L. Leiter retired in 1881, and the firm was reorganized as Marshall Field & Co. This house developed the largest retail and wholesale business of the kind in the world. It maintained its headquarters in Chicago and established branch offices in England, Germany, and France. The University of Chicago received real estate valued at $200,000, but since then it has greatly increased in value, and he made a gift of $1,000,000 to establish the Field Museum of Natural History, Chicago, in which may be seen many exhibits that were at the World's Columbian Exposition. By his will he bequeathed the institution the further sum of $8,000,000, half of which was assigned to erect a new building and the balance for endowment.

FIELD, Stephen Johnson, famous jurist, born in Haddam, Conn., Nov. 4, 1816; died in Washington, D. C., April 9, 1899. He was the brother of Cyrus West Field, secured a primary education at Stockbridge, Mass., and at the age of thirteen accompanied his sister on missionary work to Greece and Smyrna, where he remained three years and secured many advantages in learning Greek and other languages. On returning to the United States, he studied at Williams College, from which he graduated in 1837, and engaged in the practice of law in New York City. In 1848 he traveled in Europe and the following year settled in Marysville, Cal. He was elected to the Legislature the same year, in 1857 became a judge of the supreme court of California, and in 1863 was ap-

pointed by President Lincoln to the supreme bench of the United States, though belonging to the Democratic party. In 1869 he was chosen professor of law in the University of California, and in 1873 the Governor appointed him to codify and suggest amendments to the State laws. He was a member of the electoral commission in 1876 and voted with the Democratic minority. The national Democratic convention held in Cincinnati, in 1880, cast 65 votes for him as a candidate for the presidential nomination. Justice Field served longer than any other supreme court justice, the total time of service being 34 years and six months. According to a statement made by himself, he wrote 57 opinions in the circuit court, 365 in the supreme court of California, and 620 in the Federal Supreme Court, making a total of 1,042. He was an opponent of encroachments by corporations and a friend of personal liberty, and stood fearless in his opinions irrespective of policy or pressure.

FIELD GLASS, a small binocular, portable, terrestrial telescope for determining the exact distance of an object from the observer. It is used largely in armies to ascertain the distance of the enemy, and to range the guns on the basis of observations made by means of it. The common field glass resembles the telescope made by Galileo, having a large object glass to secure a brilliant image and a negative, or concave, eyeglass. An achromatic telescope, having from three to eight joints, being from fifteen to thirty inches long, is designated by the same name.

FIELDING (fēld'ĭng), **Henry,** noted novelist, born in Sharpham Park, England, April 22, 1707; died in Lisbon, Portugal, Oct. 8, 1754. He was the son of Gen. Edmund Fielding, secured an education at Eton and Leyden University, and turned his attention to the stage. The first dramatic production from his pen is entitled "Love in Several Masks," written in 1728, and was received with favor. Shortly after he became the manager of a theater, studied law, and edited several periodicals. He married Miss Craddock in 1737, by whom he came to be the possessor of some means, and the death of his mother occurring about the same time also brought a small estate in Dorsetshire into his possession. Among the chief merits of Fielding as a writer are his well-applied humor, witty pleasantry, and correct knowledge of character. His principal writings include "Joseph Andrews," "History of Tom Jones," "Journey from This World to the Next," "Don Quixote in England," "The Modern Husband," "Journal of a Voyage to Lisbon," "Temple Beau," and "History of Jonathan Wild."

FIELD OF THE CLOTH OF GOLD, the name of the place where Francis I. of France and Henry VIII. of England met from June 7 until 20, 1520, for an interview. The locality of the meeting is on a plain between Arde and Guisnes in the department of Pas-de-Calais. It was so named from the splendor of the banquets and the gorgeous trappings and apparel used by the participants. The meeting occured because Francis I. sought the friendship of Henry VIII. against Charles V. of Germany, but in this he was not successful. Interviews took place shortly after at Calais and Gravelines between Henry VIII. and Charles V. Shakespeare gives a graphic description of the meeting on the Field of the Cloth of Gold in his "Henry VIII."

FIELDS, James Thomas, author and publisher, born at Portsmouth, N. H., Dec. 31, 1817; died April 24, 1881. He attended the public schools in his native town and in 1834 removed to Boston, where he engaged in the business of publishing. For a number of years he edited the *Atlantic Monthly* and he was the publisher of Holmes, Emerson, Longfellow, Lowell, Hawthorne, and Whittier. After 1870 he devoted his time almost exclusively to lecturing and writing. His books include "Yesterdays with Authors," "In and Out of Doors with Charles Dickens," and "A Few Verses."

FIERY CROSS (fī'ĕr-ў), a cross made by the Highlanders of Scotland, who called it the *Crantara.* It was constructed of light, dry wood and the extremities were burned to a char, after which the fire was extinguished by dipping in the blood of a goat. The Fiery Cross was carried from place to place as a signal for men to hasten to arms in defense of their country. A form of the Fiery Cross is used by the Ku Klux Klan.

FIFE (fīf), a small, shrill-toned, martial instrument, either of wood of metal, in the form of a tube, having fingerholes and a blowhole or mouthpiece. It is variously pitched, usually from D on the fourth line of the treble staff upward, and the compass is two octaves. The notes are shrill and somewhat harsh. Fifes and drums have been a source of much inspiration in the army during long marches and are still held in high esteem.

FIFTEEN DECISIVE BATTLES. See Battle.

FIG, a small fruit tree native to Asia Minor, but now cultivated in all the countries adjacent to the Mediterranean. About 300 known species are recognized, most of which are characterized by large leaves. Some are trailing vines and others are great trees. The average height of the fig tree grown for its fruit is about twenty feet. In favorable climates it produces two crops of figs yearly, in the spring and autumn. The fruit is a fleshy receptacle of a conical form. It is attached to the twig by the narrow end. At the larger end is a small opening as in a pear, the flower and seeds lining the interior. The fig is used as food and is employed in medicine as a demulcent and laxative. In a fresh state for table use it can be transported only

a short distance, hence it is dried extensively and packed in boxes for the market. Dried figs form an important article of commerce, the best grade being imported from Turkey and the Levant. However, the culture of the fig has been extended very largely the past few

FIG.

A, Female Flower; *B*, Section of Fruit.

decades, especially in Australia and California, where the quality of the fruit is thought to be equal to that of Smyrna.

FIGARO (fē-gȧ-rō′), the name of a journal issued in Paris, France, celebrated for publishing contributions from Jules Janin, Jules Sandeau, George Sand, and a number of other able writers. It was so named from the comedies of Beaumarchais entitled "The Marriage of Figaro" and "The Barber of Seville." The name was afterward adapted by Mozart and Rosini, by the former in his "Marriage of Figaro" and by the latter in his "Barber of Seville."

FIGHTING FISH, a small fish allied to the perch family, so named because it is used in captivity for fighting purposes. It is a small fish and is kept in glass globes. The color is dull, when the fish is quiet, but assumes a metallic luster when it becomes excited. Fighting fishes are native to the southeastern part of Asia, where they are used for gambling purposes. They attack each other immediately on coming in contact, hence much money is spent in betting on the result of the contest.

FIGHTING JOE. See **Hooker, Joseph.**

FIGURES OF SPEECH, the variations of the literal or ordinary form of expression, the intention being to make the thought more attractive or more striking. The principal figures of speech include the simile, metaphor, allegory, personification, antithesis, synecdoche, apostrophe, hyperbole, climax, and irony. They are usually divided into figures of rhetoric, figures of etymology, and figures of syntax. Figures of *rhetoric* are used extensively in poetical composition, being figures of thought rather than of grammatical form. Figures of *etymology* refer to the forms of words, as in the use of *o'er* instead of *over*, while figures of *syntax* have reference to variations in the construction of sentences.

Simile is an expression of resemblance between two different things, as in the sentence, "Religion is to the soul what life is to nature." *Metaphor* is another figure which is founded upon the resemblance of one thing to another, but it differs from simile in that the expression is implied instead of being formally expressed. "Life is like an isthmus between two eternities" is a simile, while "Life is an isthmus between two eternities" is a metaphor. *Allegory* is founded upon resemblance, but the comparison is more extended than in simile and metaphor. It is designed to teach some abstract truth by the use of symbolic language, hence is in the nature of a short fable or parable. *Personification* consists in attributing life to inanimate things, as in the sentence, "The hungry flames swept onward." *Antithesis* is founded upon unlikeness, in which things are contrasted or opposed to each other. The expression "Science is deep as eternity; speech is shallow as time," is antithetical. *Apostrophe* is direct address to the dead as if they were living, or to the absent as if they were present. A figure of *synecdoche* consists in putting a part for the whole, or the whole for a part, as in the example, "Give us this day our daily bread." *Hyperbole* is an exaggeration, as in saying "I am tired to death." *Climax* is an ascending series of thoughts or statements which gradually increase in importance, as in "Liberty was lost,—all was lost!" *Irony* is disguised satire. We make use of this figure when we praise a thing and really mean to ridicule it.

FIJI ISLANDS (fē′jē), an island group in the South Pacific Ocean, consisting of about 250 distinct islands, of which one-third are inhabited. They are situated 7,450 miles from San Francisco, east of the New Hebrides, and have an area of 8,050 square miles. The two largest are Vanua Levu and Viti Levu, the former having an area of 2,600 square miles and the latter, 4,250 square miles. Most of the islands are of volcanic origin, but the group contains many atolls and coral reefs. Volcanic action and earthquakes are not infrequent. The climate is healthful, the soil is productive, and the natives have become largely educated and Christianized. Among the principal products are live stock, maize, cotton, copra, sugar, peanuts, tobacco, pearl shells, and fruits. The government maintains two public schools and an industrial institute, at which about 200 pupils attend. The Wesleyan missionaries direct almost entirely the educational affairs, their

schools numbering 2,075, at which 35,500 pupils attend. Besides these, there are 145 schools of the Roman Catholic mission, at which 2,150 pupils are enrolled.

The Fiji Islands present one of the most favorable examples of effective Christianizing, fully 110,000 of the inhabitants being Christians, while not more than 75 years ago the natives ranked as the fiercest of cannibals. Abel J. Tasman (1602-1659), a Dutch navigator, discovered them in 1643, and Captain Cook cruised among them in 1773. An influx of European settlers began in 1866, principally from Australia and New Zealand, and soon after the commercial interests of the Fijis grew to importance. Since 1874 they have been formally governed by Great Britain as the Fiji Colony. Suva, on the south coast of Viti Levu, is the seat of government. The inhabitants consist chiefly of Fijians, Indians, Rotumans, and Europeans, the last mentioned numbering 2,459. Population, 1922, 135,085.

FILE, a steel instrument for abrading or smoothing surfaces, having raised cutting surfaces or teeth made by indentations of a chisel. Files are of various shapes, sizes, and fineness of cut. Those in common use are either flat or triangular in form. They are said to *taper* when they are thinner toward the point; to be *parallel*, when they are of the same dimension throughout; and *blunt*, when they grade between a taper and a parallel. Some types are square, round, or half-round. They are either single-cut, having but one row of teeth, or double-cut, having two sets of teeth crossing each other obliquely. A *rasp* is a similar instrument, but has coarser teeth and is used on soft materials, such as wood and the hoofs of horses. The file is one of the most ancient instruments, and is mentioned as early as 109 B. C. Only high grade steel is used in manufacturing files. The cutting and tempering involve much skill and the use of complicated machinery.

FILEFISH (fīl'fĭsh), a class of small fishes native to the tropical and temperate waters, so named because the stout dorsal spine is armed with two rows of barbs, giving the appearance of a file. Both jaws are furnished with teeth, each having eight teeth in a row, and the body is covered with hard rhomboidal scales. The *barnacle eater*, a species of filefish, occurs in the Atlantic off New England and Newfoundland. It attains a length of eighteen inches, has a tawny color, and is frequently seen in aquariums. A species native to the Mediterranean is about two feet long. The filefish is allied to the trigger fishes.

FILIBUSTER (fĭl'ĭ-bŭs-tēr), a name applied originally to the pirates of the West Indies. The word is of Spanish origin, in which language it designates a fast-sailing vessel or flyboat. It came to be the name of the adventurers who organized expeditions in the United States to gain control of West Indian and Central American regions with the hope of having them annexed to the United States, and thus to extend the slave territory. Gen. William Walker, who was captured, court-martialed, and shot Sept. 12, 1860, was the most noted of the filibusters. The term *filibuster* has been introduced recently to designate the members of the minority of a legislative body, who seek to delay or defeat the adoption of measures obnoxious to them by raising questions of parliamentary law, making motions to adjourn, or calling for yeas and nays.

FILLMORE (fĭl'mōr), **Millard**, thirteenth President of the United States, born in Summer Hill, N. Y., Feb. 7, 1800; died in Buffalo, March 8, 1874. He descended from a family which was distinguished in the French and Revolutionary wars, worked with his father on the farm, and in 1815 was apprenticed for a few months to a carder and cloth dresser. Shortly after he taught school, but studied law in the meantime. In 1823 he was admitted as an attorney to the court of common pleas in Erie County, and in 1830 began a successful law practice at Buffalo, N. Y. His political career began and ended with the birth and extinction of the Whig party. In 1828 he was chosen to the Legislature, where he served three terms, and in 1832 was elected to Congress, securing reëlections in 1836, 1838, and 1840. He failed in obtaining the nomination for Vice President in the Whig convention at Baltimore in 1844, but was nominated for Governor of New York, for which office he was defeated by Silas Wright.

MILLARD FILLMORE.

The Whigs nominated Fillmore for Vice President in 1848 on the ticket with Taylor, and he became President on July 10, 1850, at the death of the President. An effort to nominate him for President in 1852 failed, General Scott defeating him in the convention. He made an extended visit to European countries in 1856, and while at Rome was nominated for President by the American, or Know-Nothing, party, but received only the electoral votes of Maryland. His home was at Buffalo after retiring from the Presidency, where he established the Buffalo Historical Society and frequently presided over conventions and public meetings. The important event in his time of service in the Legislature of New York, in 1829-31, was the abolition of imprisonment for debt under a bill written by him. During his Presidency the

country was prosperous and at peace. The passage of the Omnibus Bill was the most noted event of his administration.

FILTRATION (fĭl-trā'shŭn), a process by which solid particles are separated from a liquid by causing the latter to pass through porous substances, which retain the solid particles or impurities. In constructing a filter it is necessary to use materials that contain interstices or pores through which the liquid may pass, but they must be sufficiently fine to retain the solid particles. Ordinary plans for filtering may be illustrated in a device utilized in constructing cisterns, in which the water is passed through a porous substance, such as sandstone, brick, charcoal, silicated carbon, wood, gravel, powdered glass, or others by which the solid particles may be retained. The most serviceable plan is to conduct the water through a pipe to the filter, which is commonly made of various layers, such as sand, gravel, charcoal, and other substances alternated, and, after passing through them, it is dropped into the cistern or tank beneath. A partition wall of brick, through which the water passes, is not an uncommon form, the water being dropped in on one side of the wall and drawn out for use at the other side.

In order to preserve a good sanitary condition it is necessary to have the filter constructed in such a way that it may be removed and cleansed or replaced by other substances at least once or twice a year, otherwise the pores become clogged, or the mass solidifies by the particles retained, and thereby it becomes inoperative or impure. In filtering oils, syrups, ale, beer, and other similar substances it is customary to use horsehair, cloth, felt, skins, cane, clay, wool, capillary threads etc., this depending upon the character of the liquid to be purified. Charcoal made of bones is much more serviceable than wood charcoal, since it removes both the solid matter and many gases, and is utilized to reduce the color of alcoholic beverages and to whiten sugar. Mechanical devices are now used extensively to clean the water in tanks and cisterns. They are placed in the water and, by manipulating a valve, the entire body is forced through a small filtering cylinder, by means of which the particles become separated and are thrown out. However, it must be borne in mind that filtration removes only substances suspended mechanically in the liquid, while impurities or foreign substances existing in a dissolved state can be removed only by distillation. See **Distillation.**

FINCH, the popular name of various small birds, many of them having fine plumage and a beautiful song. They are usually called *hard-billed* song birds to distinguish them from the warblers or *soft-billed* songsters. Not less than 550 species have been described, of which 135 are found in Canada and the United States. Various species of the finches inhabit nearly all parts of the globe, except Australia, but they are most abundant in the Northern Hemisphere. They are variously known as bullfinch, chaffinch, hawfinch, and pinefinch. These birds may be distinguished by their strongly formed bill, suitable for crushing seed, which is their favorite food.

FINCK, Henry Theophilus, musical critic, born in Bethel, Mo., Sept. 22, 1854; died Oct. 1, 1926. He removed to Portland, Ore., at an early age, where he attended school and studied music. After studying Latin and Greek by himself, he entered Harvard University in 1872, where he pursued the study of music, philosophy, and the classics. Later he studied at Berlin and Heidelberg, and in 1881 engaged as musical editor of the New York *Evening Post.* In the theories of music he supported Wagner, of whose compositions he was the leading advocate in the United States. Among his published works are "Pacific Coast Scenic Tour," "Wagner and His Music," "Chopin, and Other Musical Essays," "Romantic Love and Personal Beauty," "Lotus Time in Japan," "Pictorial Wagner," and "Songs and Song Writers."

FINDLAY (fĭnd'lā), a city in Ohio, county seat of Hancock County, on the Blanchard River, about 42 miles south of Toledo. It is on the Big Four, the New York Central, the Nickel Plate, the Baltimore and Ohio, and other railroads. The surrounding country has extensive deposits of petroleum, natural gas, and fire and potter's clay. Among the noteworthy buildings are the county courthouse, the city hall, the public library, and the high school. It is the seat of Findlay College (Church of God) and has a hospital and an orphans' home. Among the manufactures are gloves, machinery, ironware, earthenware, clothing, sugar, baskets, flour, pottery, and stoves. It is the focus of several electric interurban railways. The city has waterworks, pavements, sewerage, and a public park. It was incorporated in 1837. Population, 1900, 17,613; in 1920, 17,015.

FINE ARTS. See **Art; Architecture; Sculpture,** etc.

FINGAL'S CAVE (fĭn'gąls kāv), a celebrated natural cavern on the island of Staffa, off the western shore of Scotland. The basaltic columns consist of immense dikes with diversified though symmetrical forms, and are joined to the rocks with much beauty. At the entrance it is 42 feet wide and at the end it has a width of 22 feet. It is 227 feet long. The height of the arched roof is 65 feet. The cave can be entered by small boats, since the low-water mark in the cave is about 20 feet. This cavern presents one of the most picturesque of the many nonvolcanic igneous eruptions found in the earth's crust.

FINLAND (fĭn'lạnd), an independent country of Europe, in the northwestern part, with an area of 149,550 square miles. It is bounded on the north by Norway, east by the governments of Archangel and Olonetz, south by the

Gulf of Finland, and west by Sweden and the Gulf of Bothnia. The region includes many lakes and marshes, the largest of the lakes being Kalla, Enare, Tornea, Saima, Päyänne, and Ladoga. Many of these lakes are connected by canals, whereby commercial enterprise has been greatly facilitated. The railroads, with a total of 2,090 miles, are under government control and furnish connection with all the important commercial centers. The rivers are unimportant, and no great mountain elevations exist. It has vast forests of conifers and oaks, which cover about one-third of the land surface, though coal and extensive fossils do not abound. Granite, copper, and iron ore are the chief minerals. Among the chief agricultural products are wheat, oats, rye, and barley. The climate is affected by the adjacent water surface, rendering it suitable for the production of pears, apples, cherries, and small fruits, but the larger species thrive only in the southern portions. Many of the lakes and streams abound with salmon, trout, perch, pike, and other food fish. All the domestic animals common to Europe are reared with profit, especially cattle, horses, sheep, and swine. The principal exports are fish, meat, leather, textile fabrics, lumber, and grains. Coal, raw cotton, and foodstuffs are imported. The largest share of trade is with Sweden, Russia, and Germany.

Government. The executive authority is vested in the president, who is assisted by a responsible cabinet. A new constitution went into force in 1917, under which the legislative function is exercised by a diet of 200 members, who are elected by universal suffrage without distinction of sex. The state of education, like that of the Scandinavian countries, is on a high plane of efficiency, and greatly excels that of Russia and the Baltic Provinces. Nearly the entire population is able to read and write, the result of compulsory attendance laws and a free school system for both sexes. Helsingfors is the seat of literary life and impulse. A university supported by government grants is maintained at Helsingfors, which has an attendance of 2,350 students.

Inhabitants. The people consist mostly of Finns, whose language, the Finnish, is generally spoken, but the higher classes generally speak Swedish. Lutheran, the established religion, is the faith of practically the entire population; only 48,500 belong to the Greek Church. Only a small per cent. of the inhabitants are Russians, but the country has a considerable number of Swedes, Lapps, and Germans. Helsingfors is the capital and chief city. Other cities include Abo, Tammerfors, and Wiborg. Population, 1922, 3,365,876.

Language. The Finns are allied to the Magyars of Hungary and the Laplanders, and differ in language and habits from the Russians and Swedes. The language is classed with the northern division of the Turanian or Uralo-Altaic family, which is spoken by the people of Lapland, Olonetz, and Archangel. Their literature is valuable on account of the richness and beauty of its poetry, and the language is not only agreeable, but has a wealth of vowels and diphthongs, and is uncommonly flexible. Within recent years several lexicons and treatises on their history, language, and literature have been published, while their tongue is taught in many of the higher educational institutions.

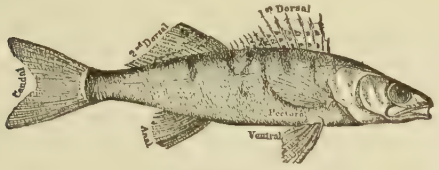
History. The Finns had independent chiefs up to the 12th century and were a warlike people. They were conquered by the Swedes about 1150 and their conversion to Christianity followed soon after. Peter the Great of Russia secured a portion of their territory by treaty in 1721, and Russia conquered the remainder from the Swedes in 1809, since which time it has belonged to that country. In 1903 the privilege of autonomy was removed, but it was restored in 1905, at the time of the general strike in Russia. At the same time woman suffrage was established. In 1917 it declared its independence from Russia.

FINLAND, Gulf of, an extensive arm of the Baltic Sea, extending to the east between Finland on the north and the Russian governments of Saint Petersburg and Esthonia on the south. The width is from 10 to 75 miles and the length is 250 miles. It receives the outflow from Lakes Ladoga and Onega. Within the gulf are numerous islands, sandbanks, and shoals. The Russian government maintains several forts on the gulf. The shores are rocky and precipitous and the waters only slightly salty. It has a number of fine harbors, including those of Wiborg, Kronstadt, Reval, and Helsingfors.

FINNEY (fĭn'nĭ), **Charles Grandison,** clergyman, born in Warren, Conn., Aug. 29, 1792; died in Oberlin, Ohio, Aug. 16, 1875. Being licensed to preach in 1824, he soon entered upon evangelistic work and attained marked success in Troy, Utica, Boston, Philadelphia, and New York. In 1835 he became professor of theology at Oberlin College and was its president in 1851-66. Later he labored in Europe as a revivalist for three years. Among his publications are "Sermons on Important Subjects," "Lectures on Revivals of Religion," "Sermons on Gospel Themes," and "Lectures to Professing Christians."

FINS, the organs of fish which serve to propel, balance, or steer them in the water. They usually consist of rays of bones covered with an elastic membrane. The *pectoral* or breast fins, a short distance behind the gills, are modifications of the anterior limbs in other vertebrate animals, and the *anal* fins, near the anus, correspond to the hind limbs. The *dorsal* or back fins are from one to four in number, depending upon the species, and the *ventral* or belly fin usually is a modification of the skin.

The tail is known as the *caudal* fin. Fins are usually divided into *paired* and *unpaired,* the former including the pectoral and sometimes the anal and the dorsal. The term *fin* is often



FISH, SHOWING FINS.

applied to the paddles of a whale, but never to the hind feet of seals or the webbed feet of birds.

FINSEN, Niels Ryberg, scientist, born in Denmark in 1861; died in 1904. He attended the University of Copenhagen, where he graduated in 1890, and founded a successful medical practice in that city. His success in treating diseases by the use of light rays, especially tuberculosis of the skin, caused the government of Denmark to aid him in founding near Copenhagen the Finsen Medical Light Institute. His successful experiments did much in extending the use of electricity in the medical profession. He was awarded the Nobel medical prize in 1903.

FIORD (fyôrd), or **Fjord,** a name first used by the Scandinavians in describing a narrow bay that penetrates inland, and which is characterized by steep, rocky walls. Inlets of this kind are very common in Norway, and are thought to have originated from the combined action of glaciers and waves. Sogne Fiord, the most notable fiord of Norway, extends inland about 100 miles, and for this entire distance has very high and precipitous walls of rock. Similar inlets occur on the coasts of Nova Scotia and New England, and they prevail more or less in British Columbia, Greenland, Patagonia, and New Zealand. The lochs and firths of Great Britain are in many respects similar to fiords.

FIR (fẽr), a name once used coextensively with the widest sense of the word *pine,* but now restricted by botanists to the one genus *Abies,* which includes the spruce fir, silver fir, Norway spruce, and other species. The trees of this genus belong to the family *Coniferae.* They are distinguished from the pines by the flat, rounded apex of the scales of their cones, and by leaves not in clusters of definite number. Fir trees are found in many parts of Eurasia and America, where they occur in fine forests, and the lumber and other products derived from them are important articles of commerce. From the *Norway spruce* is obtained lampblack, tar, turpentine, resin, and Burgundy pitch. The bark is used in tanning and for making baskets, the roots yield fibers for cordage, and the wood is employed for fuel, housebuilding, and making masts and spars of ships. In the market the wood of the Norway spruce is known as Christiania deal and Dantzic deal. The *white spruce,* or *white fir,* which ranges from Lower California to British Columbia, is one of the finest trees of that region and attains a height of 300 feet. *Hemlock* forms dense forests in the northern part of the United States and Canada, extending as far as Hudson Bay. The bark is valued for tanning, while the wood is used for construction purposes. In the northwestern part of North America is found the *Douglas fir,* often growing 250 feet high. Spruce beer is made from small branches of the *black spruce,* and Canada balsam is obtained from the *balm of Gilead fir.*

FIRDAUSI (fêr-dōō′sĕ), or **Firdusi, Abdul Kasim Mansur,** epic poet, born near Tus, Persia, about 940; died in 1020. He is sometimes called Thousi from the place of his birth, but from his poems he is called Firdausi, which has reference to both garden and paradise. The Sultan Mahmud invited him to his court at Ghuznee, or Ghazni, where he came in contact with the most distinguished scholars and poets of his time. His great work, entitled "Shah Nameh," treats of the history of Persia from remote antiquity until the Mohammedan conquest in 641 A. D. It contains 60,000 verses, and is more than seven times larger than Homer's "Iliad." The "Shah Nameh" is the oldest poetic work of Persian literature, and is regarded by the Orientals as the highest

BALSAM FIR.

authority for the primitive history of Western Asia. It was adopted by the disciples of Zoroaster, and was translated into a number of European languages. Jacob Joseph von Görres (1776-1848) translated it into German and Jules Mohl made a French translation. An English translation was published in 1831.

FIRE (fir), the evolved heat and light produced by ignition or combustion. The vividly perceptible ascending stream or current exhib-

ited in the combustion of gases is called a *flame*. In ancient times it was regarded one of the four primary elements of which all things were thought to be composed, the other three being earth, air, and water. Among the ancients and even within comparatively recent times many superstitions regarding fire were common, such as led to fervid and devoted fire worship. Many uses of fire were known very early, though some of the common methods of producing and controlling it are quite recent. The newer methods include its production by inflammable matches and its extinction by chemical compounds, as by a mixture of dried ferrocyanide of potassium, chlorate of potassa, and sugar set in action by sulphuric acid, or by mechanical agencies.

FIRE ALARM (ā-lärm'), an apparatus for communicating warning of a fire, either electrical or mechanical. An automatic arrangement is now in use which depends for its action upon the increased temperature of the air in the vicinity of the fire, or of the burning away of certain connecting cords which are stretched in exposed situations. In large cities there are stations where any person discovering a fire may turn in an alarm by touching an electric button, which immediately gives the street and number of the house on fire, at the central station, whence relief may be speedily despatched.

FIREARMS. See **Cannon; Gun; Rifle,** etc.

FIREBALL. See **Meteors.**

FIRE CLAY, a variety of clay found in a stratum below the coal formations and sometimes elsewhere. It is used in the manufacture of brick, tile, gas retorts, and other vessels suitable to withstand high temperatures. The principal constituents of fire clay are silica and alumina, accompanied by small proportions of iron, lime, magnesia, water, and organic matter. Fire clay is found extensively in Canada and the United States and occurs in all the continents.

FIRECRACKERS. See **Fireworks.**

FIRE DAMP, an explosive coal-gas generated in coal mines, consisting chiefly of light carburetted hydrogen. When fire damp is mixed with from five to fourteen per cent. its volume of atmospheric air, it is explosive. It is very dangerous to miners, the principal protection being the safety lamp, though in most cases danger can be avoided by a good system of ventilation. Edison invented an electrical safety lamp which gives a strong light for several hours at a very trivial expense and, when any accident occurs to break the globe, the light instantly becomes extinguished.

FIRE DEPARTMENT (dē-pärt'mẹnt), an organization maintained in towns and cities as a means of protection against fires. This department of a municipal government is supported by general taxation and may be either paid or voluntary. A *paid fire department* is one in which the chief and his assistants are employed regularly on a salary, while a *volunteer department* is made up of members who serve only when called by a fire alarm, and they are paid only for the time they actually attend fires. Some cities maintain both classes of organizations, as a means of security during large conflagrations, and the volunteers are paid only for the actual time of service.

Paid fire departments are maintained in practically all towns and cities that have a population of more than 9,000, and those in charge as employees of the city give their entire time, both day and night, to the duties incumbent upon them. The smaller cities have a single fire station, while the more populous places have a central and several branch stations, where the fire engines, ladders, chemical engines, hose carts, and other supplies are kept ready for use. One or more teams of well-trained horses are kept ready for call in the stalls at the station. When an alarm is given by electrical devices, they take their places under the harnesses which are suspended in position before the engine or fire wagon, and the men, who promptly slide down poles from the room above, clasp the harnesses and are ready to start for the scene of the fire without delay. Hose are attached to the hydrant of the waterworks, which supplies the necessary pressure, or, where an engine is used, the pressure is obtained through it, and the water is pumped direct from the hydrant. In many instances chemical engines are used. Cities have discontinued the use of horses entirely, and the fire departments are motorized throughout.

FIRE ENGINE (ĕn'jĭn), a machine designed to throw water for the purpose of extinguishing fires. Mechanical devices for saving buildings and cities from destruction by fire were used more or less for many centuries, though it is only within recent years that they have been brought to a high state of efficiency. They are mentioned in Roman history by Pliny, and appear to have formed a part of the municipal facilities of Athens, Carthage, and Alexandria. Several mechanical devices for throwing water to considerable heights were used extensively in Europe in the 16th century, the most successful of which were built in Augsburg, Germany. Similar machines were constructed at Nuremburg in 1657 and at London in 1730. They came into use in the cities of Canada and the United States about 1731. At present some form of fire engine is a part of the necessary equipment for municipal protection, not only in every city, but in all the towns and hamlets.

Fire engines are a class of force pumps by which the water is subjected to a pressure sufficient to raise it to the necessary height, and are now generally worked by steam. In the smaller engines a cistern holds the supply of water, though in the larger a direct connection with the city water supply furnishes the neces-

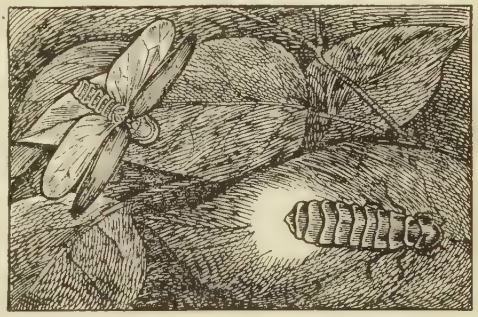
sary quantity to be rapidly thrown to great heights on burning structures. Steam fire engines have either rotary or piston pumps constructed on a single or double plan, with either tubular flue or coil boilers. The larger weigh about five tons, though engines weighing about three tons are preferred on account of greater facility in moving them hastily to the point of danger. The capacity of these engines is from 200 to 900 gallons per minute, the flow of water being controlled by an automatic relief valve.

Fire engines are commonly drawn by gasolene power, though steam is employed in the larger cities, with good results. The first fire engine to be propelled by steam was used successfully in New York City in 1873. Many seaports have fire engines that are mounted on fire boats. In smaller cities and villages chemical fire engines are used with good results. By these a stream of water from one fourth to three fourths of an inch may be thrown 200 feet by means of a chemical mixture with water, which produces carbonic acid gas and supplies the pressure necessary. A hose cart is used in connection with fire engines. It consists of a four-wheeled vehicle, supplied with about 1,000 feet of hose, and is moved along with the fire engine to the place of danger, but in many of the newer chemical engines the hose is carried on the engine itself. The hose is made of cotton fabric. It is usually lined within and covered without by rubber, though there are several varieties manufactured for the trade.

FIRE ESCAPE (ĕs-kāp′), a device for enabling persons to escape from the upper parts of high buildings. Most tall, modern constructions are provided with iron ladders extending from the top of the building to the ground on the outside of the brick or stone work. They are put up as the masonry is built. Ladders capable of being drawn out like a telescope are preferred in some classes of buildings. Rope ladders with hooks at one end are a part of the equipment of many of the more important hotels and of some travelers. In many cases large nets of stout sailcloth or slender ropes are utilized for lowering persons to the ground, or for them to jump into while held from the ground by the firemen. Persons weighing 200 pounds can safely jump one hundred feet into these nets. Some cities are provided with a cannon that shoots a projectile with a cable or rope attached over the building in which the danger occurs, and it is then fastened to form a means of escape. The construction and use of fire escapes are regulated by law in most countries.

FIRE EXTINGUISHERS (ĕks-tĭn′gwĭsh-ĕrz), the chemical agents utilized in extinguishing fires. Various compounds are recommended for the purpose, the most common being a mixture of chlorate of potassa, sugar, dried ferrocyanide of potassium, and water, and, when sulphuric acid is brought in contact with it, gases are liberated and the whole is directed to quench the flame. All rooms in first-class hotels, passenger cars, and passenger compartments in steamboats are supplied with bottles of chemical fire extinguishers, by means of which conflagrations may be averted by prompt action.

FIREFLY, the name commonly applied to all winged luminous insects. They abound in all the warmer latitudes, especially near wet and marshy grounds. Some have a steady glow, but most species, as they fly, emit and conceal their light with much regularity at intervals of three or four seconds. In most of these insects the light proceeds from the last three segments of the abdomen. An adult firefly is shown in the accompanying figure, together with a larva and a glow worm (q. v.).



GLOW WORMS.
Male winged. Female wingless.

In most species of elaters the larva is more or less luminous. The common firefly or lightning bug is not much over half an inch long. Some species found in the West Indies are larger and emit light so powerful that small print may be read by means of it, while a fair light may be secured by confining a number in a glass vessel. Several species native to the West Indies emit light from two eyelike tubercles on the thorax.

FIREPROOFING, a term used to describe the construction of buildings, treatment of portions of buildings, or apparatus by which they become partly or wholly invulnerable to damage by fire. The safeguards adopted early in the history of constructive building consisted of using brick or stone, and later iron entered into doors, lintels, and stairways. These and other methods are now in common use, while in large cities every building must be constructed according to certain specified conditions provided by the city authorities. Wood treated with silicate of soda is made largely proof against fire, since the application of strong heat fuses it into a kind of glass that forms a shield of protection. Cloth or wood does not blaze, if impregnated with certain saline substances, such as phosphate of soda or ammonia,

borax, alum, and many other chemicals. Cloth may be treated with graphite in a bath and then placed in an electro-metallic bath apparatus by which the cloth is coated with metal. Woolen and ordinary fabrics are rendered fireproof by being treated with borax, alum, or soluble glass.

Papers and valuable documents are preserved in fireproof safes, which are constructed with double walls, having the intervening space filled with a nonconductor of heat. In the tall buildings of cities marked precaution is taken in the construction of all portions exposed to view, and, as a further safeguard, metal shutters are used to protect the outside windows against the entrance of fire from a neighboring building while burning. Besides, water pipes extend from the basement to the upper story, these being connected with pumps below, and there are water buckets, hand grenades, and mechanical extinguishers for protection against incipient damage by fire. In many structures are stairways and openings by which entrance and passage of firemen to all parts of the building are facilitated. By these and similar means it is possible to protect and guard the larger centers of commerce against widespread fires, such as have destroyed portions of London, New York, Philadelphia, Chicago, and other cities at different times.

FIREWORKS, the common name of preparations containing combustibles and explosives, such as charcoal, niter, and sulphur, with chemicals producing colored lights or scintillations in burning, and used to make displays at festivals, expositions, or at times of public rejoicing. Many forms are made, according to the effects desired, such as crackers, rockets, squibs, Roman candles, torpedoes, balloons, wheels, and other arranged pieces. Some are contrived with ingenuity and skill, and, when ignited, represent various pictures and devices. The powder utilized in fireworks is made according to the same principle as gunpowder, but with it are used charcoal, niter, sulphur, and other substances to influence the explosive properties and give tint or coloring. Filings of zinc impart a bluish color, iron or steel filings increase brightness, while a greenish tint is secured by copper filings. Besides this class, such chemicals as salt, lampblack, amber, and resin are used.

The Chinese and Hindus manufactured fireworks many centuries before they became known to the Europeans, largely for the reason that they knew of gunpowder much earlier than western peoples. They utilized them at festivals and celebrations. Many of the different devices employed in producing noise and illuminations at night are of Chinese manufacture, though within recent years large establishments have been built in Europe and America at which all classes of fireworks are manufactured. The largest establishment of this character is located in New Jersey. Firecrackers are among the most popular devices used at celebrations. They consist of a tube made of strawboard, are from two to fifteen inches in length, and have a diameter equal to about one-tenth of the length. The newer process of manufacture has made it possible for one person to make about 2,500 tubes per day. These tubes are plugged with pasteboard wad, cord, or pith at one end and at the other with clay or wood pulp, and in the latter a fuse is placed. The explosive is on the interior and with it the fuse articulates. When finished, the firecrackers are covered with an artistic red paper, dried, and packed ready for the market.

FIRE WORSHIP. See Parsees.

FISCHER (fĭsh'ẽr), **Ernst Kuno**, noted philosopher, born in Silesia, Germany, July 23, 1824; died July 4, 1907. He studied in Posen, Leipzig, and Halle, graduating at the last named place in 1847. He became a teacher of philosophy at Heidelberg in 1850, but was deprived of the position three years later because the charge that he inclined to pantheism had been preferred against him. In 1856 he secured a chair at Jena and in 1872 succeeded Zeller at Heidelberg, where he aroused much interest in philosophical research. Among his principal writings are "History of Modern Philosophy," "Critique of Kant," and "System of Logic and Metaphysics." Several of his works have been widely translated and are used as texts in divers countries.

FISH, a group of vertebrate animals which live in water and breathe by gills. They are distinguished by having paired fins and by not breathing by lungs in any stage of life. Their

SKELETON OF FISH.

form is well adapted to permit them to move easily and rapidly through the water, tapering toward the extremities, but exceptions are numerous. The typical character of the skeleton is evidently homologous with those of quadrupeds and man. The four limbs belonging to the usual structure of vertebrate animals assume the forms of fins. Fins, gills, and, most generally, scales are distinguishing features of fish. The heart contains only one auricle and one ventricle, receiving venous blood only, and sending it to the gills, where it is oxygenated and passed by the dorsal vessel into the greater and only circulation. Fish, with few exceptions, are cold-blooded animals; that is, they have a temperature little above that of the water in which they

(Opp. 1004)

FOOD AND GAME FISH OF NORTH AMERICA.

1. Yellow Perch; 2, Burgall; 3, Pickerel; 4, Red Snapper; 5, Mud-Fish; 6, Black Bass; 7, Sea Bass; 8, Shad; 9, Brook Trout; 10, Canadian Red Trout; 11, Sunfish; 12, Bullhead.

live. When taken from the water, they die in consequence of the drying up of the fine fringes of the gills.

In most fish the gills are situated at the back part of the sides of the head, usually four on each side, and consist of folds of membrane attached to the surface of the gill cavities, or a multitude of vascular membranous plates, generally in double fringelike rows fixed by the base. The gill orifices are covered by a bony plate whose motion expels the water, which is taken in by the mouth to supply the gills with air. Fishes possess nerves and organs of all the senses, although the senses of touch and taste are dull compared with those of many other animals. Some fish are destitute of sight, while most species have large eyes and a very acute vision. Others have no teeth, but many species have a large number. The air bladder, an organ aiding them to maintain an equilibrium in the water, is found in many kinds.

Fishes reproduce by means of *spawn*, or *eggs*, which, in some species, are fertilized in the body of the female and in others fecundation takes place at the time or after they have been extruded. The eggs are usually deposited in sand or gravel where the water is shallow. Many species leave the depths of the ocean and pass into fresh water for this purpose. A single codfish is said to lay nine million eggs. As a rule, they show no parental care either for their eggs or young, but some species build nests and watch over them. Fish, being cold-blooded, need no covering for warmth; hence, the scales serve for protection or as a defensive armor. While the skin of cartilagineous fish yields shagreen and the bladder of some fishes isinglass, by far their most important use consists in supplying man with food.

Many species known as *deep-sea fish* are very peculiar and formerly were not known to exist. Many of them have no eyes, for the reason that sunlight is absent from the depths at which they thrive. Their peculiar structure enables them to withstand the low temperature and enormous pressure that are common at great depths. They live almost, if not entirely, upon animal life, as plants do not grow without the influence of sunlight. Many of the species have extended mouths and dilatable stomachs, which enable them to swallow and digest bodies much larger than themselves, or strain out material from sediment that settles down from above. The fins and tail are long and delicate, because of the perfect calm at such depths. See Fins.

FISH, Hamilton, statesman and diplomatist, born in New York City, Aug. 3, 1808; died Sept. 7, 1893. He graduated from Columbia College in 1827, studied law, and in 1830 was admitted to the bar. Subsequently he was elected to Congress as a Whig, serving in the Lower House until 1845. He was Lieutenant Governor of New York in 1847-48, served as Governor of the State in 1849-51, and was elected a member of the United States Senate soon after. On retiring from Congress, he traveled in Europe several years, and received an appointment as United States minister to France. In 1869 President Grant made him Secretary of State, which office he filled with marked ability. Among a number of foreign disputes settled during his incumbency is the one relating to the Alabama claims.

FISH, Stuyvesant, capitalist, son of Hamilton Fish, born in New York City, June 24, 1851. He was educated at Columbia University, and in 1871 was appointed a clerk in the New York office of the Illinois Central Railroad Company. The following year he became secretary to the president of that company, was made a director in 1876, and held other important offices with other railroad companies. He was elected president of the Illinois Central in 1887, and did much to extend its lines and build up its business interests. In 1897 he was a member of the monetary commission created by the conference in Indianapolis. He was opposed in his official capacity as a promoter of the Illinois Central Railroad by Edward Henry Harriman and engaged in a long contest in 1907, but was outvoted by those holding stock. He died April 9, 1923.

FISH CULTURE (kŭl'tûr), the industry embracing the education and labor devoted to the growth and propagation of fish. The ancient Egyptians and Chinese were highly skilled in pisciculture and gave it marked attention, for the reason that the subsistence of large masses depended to a vast extent upon the food-producing qualities of their interior and adjacent waters. Since then the art may be traced through successive centuries. It is not difficult to realize the vast benefit that the industry yields to the people of Western Europe, and its wholesome influence upon the commercial aspects of America. Since the large fish feed upon the smaller, and the latter upon the eggs, it is apparent that these influences, in connection with the fishing industry, tend to greatly limit and ultimately depopulate the waters of the finny tribe.

The discoveries made by Stephen Ludwig Jacobi, of Westphalia, Germany, in 1748, led to the art of increasing fish by stripping the females of their eggs and fertilizing them by the milt taken from the male fish. From this discovery and those made later by L. J. R. Agassiz it became possible to breed and rear fish more extensively than had been possible previously, and by skillful application and care preserve, feed, and fatten them. We find as a result that waters before unproductive have been populated with various species, such as the California salmon, California brook trout, char, whitefish, shad, and German carp. Many streams and lakes have been populated with

fish, as the shad, which has been planted in the rivers of Georgia, and the whitefish fry has been introduced in Lake Erie. Besides, the waters of California, Canada, and many European countries have been restocked, and the more valuable kinds have been greatly increased in numbers.

Much advancement has been made in fish culture in the United States, where it is now pursued more extensively than in any other country. The industry is under the jurisdiction of the United States Fish Commission, a bureau established by act of Congress, Feb. 9, 1871. The primary object originally was to investigate the food fish of the seacoast and inland waters of the United States. Since then the duties of the bureau have been widely extended, and the whole now constitutes one of the most important functions in the service of the government. Many valuable reports and bulletins have been distributed annually, these relating to various branches in the different phases of the industry. They have been instrumental in disseminating accurate and scientific knowledge of the art. The several states have been supplied with various kinds of fish, the annual distribution often aggregating 200,000,000 eggs and fish, of which three-fourths are infant and adult fish and about one-fourth are eggs. At colleges of agriculture and other institutions under State and Federal control, such as are now quite common, the industry has been carefully studied. Along with fish culture proper, the artificial culture of lobsters, oysters, mussels, and other crustacea is growing in importance.

FISHER (fĭsh'ẽr), **George Park,** clergyman and historian, born in Wrentham, Mass., Aug. 10, 1827. He attended school at Wrentham, and graduated from Brown University in 1847. Subsequently he studied theology at Yale Divinity School and in Germany, and was professor of divinity in Yale from 1854 until 1861. In the latter year he became professor of ecclesiastical history in the same institution, in which he served with much efficiency a long term of years. He ranks as one of the leading Congregational clergymen and church historians of the United States. Among his publications are "History of the Reformation," "Discussions in History and Theology," "History of the Christian Church," "Faith and Rationalism," "Manual of Christian Evidences," "The Beginnings of Christianity," and "History of Christian Doctrine." He died Dec. 20, 1909.

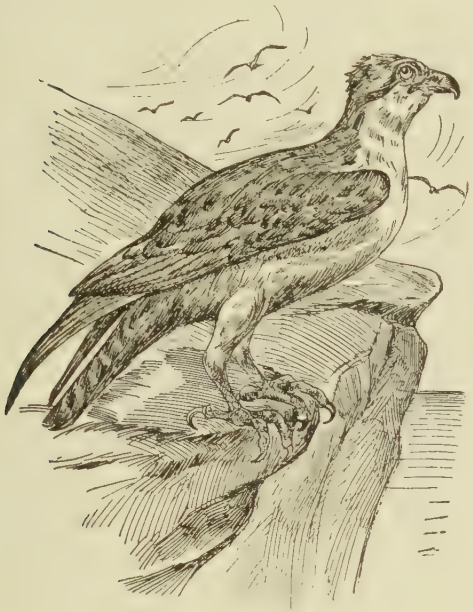
FISHERY (fĭsh'ẽr-ў), the business of catching fish or other aquatic animals, but relating also to the locality where marine life and fish are found in paying quantities. The objects for which fishing is conducted include pearls, corals, sponges, whales, turtles, shellfish, seals, and many others, besides the various species of fin fish. Among the chief methods of fishing are those employing drawnets, spears, lines, and dredges. The most important of the fresh-water fisheries include those of the salmon, in which sportsmen employ fly hooks, while fishers generally use stakenets and drawnets. Other important fresh-water fish embrace the perch, eel, trout, pike, and catfish. Measured from the standpoint of profit, the oyster, cod, herring, and haddock are the most productive sea fisheries. Countries bordering on the sea naturally possess the most valuable fisheries, among which Canada and the United States take very high rank.

Disputes regarding fishery rights have taken on the form of international questions, and have occupied the attention of diplomats, especially those involving the United States and Great Britain at different times. The Bering Sea question, which occupied the attention of both governments for some time and attracted particular attention in 1896, is one of the most important. Under the fishery laws the owner of the soil and streams, or bodies of water, is entitled to the exclusive right to fish in such water. Where the owner has land adjacent to both sides of the stream, he enjoys the sole right to fish in the entire stream lying between his property, and, where his possessions are only on one side, his right extends to the center of the stream. In streams and bodies of water belonging to the State or Federal government the right to fish is abridged or authorized by general laws. In many of the states fishing is strictly prohibited, except at certain periods of the year, even in the bodies of water belonging to private owners, while in some it is made unlawful to fish with drawnets and to use more than two or three hooks on a line. Such legislation is deemed necessary in order to protect the waters from being totally depopulated, and to preserve a fair aggregate of the different kinds of fish at all times. Besides, damaging influences, such as dams, the discharged sewage, and other unwholesome and obstructive agencies, are prohibited under suitable penalty, and it is made the duty of officers to prosecute investigation for proper protection.

Newfoundland has some of the most valuable fisheries in the world, especially in cod, herring, and haddock. The Great Lakes yield whitefish, sturgeon and Michigan herring. Salmon are caught in large numbers on the Pacific coast, especially at the mouths of the Fraser and Columbia rivers. Manitoba and Minnesota are especially noted for the fisheries in hundreds of lakes. Rapid transportation by railways has made it possible to supply many sections of the country with fresh fish, even in the summer season.

FISH HAWK, an eagle or other rapacious bird which preys upon fish, as the bald eagle or the osprey. This genus of birds is widely diffused, being found both in warm and cold climates, and is grouped with the family Falconidae. It is singular among the falcons in preying exclusively upon fish, and to this end its whole structure and habits are adapted. The

fish hawk is about 22 inches long, and has a dark brown color variegated with gray and white. It has a short, broad, rounded bill, a long tail, expansive wings, and remarkably rough scaly, pointed toes, suitable for grasping its slippery prey. The feathers are destitute of supplementary plumes and very oily. These



OSPREY.

birds are found near the sea, lakes, or rivers, and are everywhere birds of passage, going toward the warmer zones soon after the appearance of frost. They catch their prey by diving into the water and grasping it with the talons.

FISK (fisk), **Clinton Bowen,** soldier and educator, born in Greigsville, N. Y., Dec. 8, 1828; died July 9, 1890. His parents removed to Michigan in 1830, where his father founded the town of Clinton. After studying at Albion and Ann Arbor, he settled in business, in Coldwater, Mich., and later in Saint Louis, Mo. In 1861 he entered the Union army, was promoted successively until he attained to the rank of brevet major general, and became a commissioner of the Freedmen's Bureau. Later he founded the Fisk University at Nashville, Tenn., an institution for the education of colored men and women, of which he was president until his death. Numerous educational and religious institutions received the benefits of his munificence. In 1888 he was nominated for president of the United States by the Prohibition party.

FISKE, John, historian and lecturer, born in Hartford, Conn., March 30, 1842; died July 5, 1901. In 1863 he graduated from Harvard University, studied law, and lectured at Harvard on philosophy and history. While attending that institution he was assistant librarian. He became recognized as a deep and forcible thinker and a powerful lecturer, by which he attracted the attention of both Darwin and Herbert Spencer. His special subjects in writing and lecturing were evolution and history, two themes in which he took marked interest. He lectured on American history at the University College and Royal Institute of Great Britain in the winter of 1879-80, where he became highly popular. After returning to America, he was appointed professor of American history in Washington University, Saint Louis, though he made his home at Cambridge, Mass. His contributions to the subject of evolution have attracted widespread attention, while those relating to the history of America are thoughtful, scholarly, and imperishable. Among his publications on evolution are "Myths and Myth Makers," "Destiny of Man," "Excursions of an Evolutionist," "Outlines of Cosmic Philosophy," and "Idea of God as Affected by Modern Knowledge." Those relating to history include "A History of the United States for Schools," "The War of Independence," "Beginning of New England," "American Political Ideas," "Civil Government of the United States," "Essays, Literary and Historical," and "Critical Period of American History."

FISKE, Minnie Maddern, actress, born in New Orleans, La., in 1865. She descended from a family of stage people, her father being Thomas Davey and her mother Lizzie Maddern, and in 1890 she married Harrison Grey Fiske. At the age of three years she appeared as the *Duke of York* in "Richard III." at Little Rock, Ark., and although she devoted much time to the stage her general education was carefully supervised. In New York she played successfully in "Hunted Down" and in "King John," and she toured in many parts of the United States. After her marriage she retired from the stage for rest and study for three years, after which she again followed stage life. She attained a reputation as a powerful actress in pretentious plays, and was particularly strong in sustaining emotion. Plays in which she succeeded best include "A Doll's House," "Marie Delroche," "Cesarine," and "A Light from Saint Agnes."

FISK UNIVERSITY, an institution of higher education for colored persons, organized by Clinton Bowen Fisk at Nashville, Tenn., in 1865. The institution is coeducational under the jurisdiction of the board of trustees, and maintains courses of study in high school grades, normal teaching, industrial arts, and advanced sciences. It has about 40 instructors, 650 students, a fine line of apparatus, and a library containing about 10,000 volumes. The value of the property is $500,000.

FITCH (fich), **John,** inventor, born in South Windsor, Conn., Jan. 21, 1743; suicided in 1798. He was the son of a farmer, secured a common school education, and went to sea at the age seventeen years. Later he became successively

a clockmaker, brass founder, and silversmith. Subsequently he served as deputy surveyor in Kentucky, and in 1786 founded a company for experimenting in steam navigation. He built a steamboat for conveying passengers on the Delaware, which developed into a successful enterprise, though the immediate undertaking proved a losing one and caused the dissolution of the company. In 1793 he proceeded to France for the purpose of introducing his invention, but met with no success. On returning to America he found squatters had settled on his property purchased in Virginia, while his invention brought him nothing but disappointment and poverty, which finally led to his sad death. The steamboat built by Robert Fulton was declared by a committee appointed in 1817 to be practically the same as the one John Fitch patented in 1791. It is certain that the result of his labor and ingenuity has been of lasting benefit to commerce and industrial enterprises.

FITCH, William Clyde, author and playwright, born in New York City, May 2, 1865. He graduated at Amherst College in 1886 and gave his attention to literature. His first story, "The Knighting of the Twins," was published while he attended college, and in 1890 his "Beau Brummel" was brought out at the Madison Square Theater by Richard Mansfield. He not only wrote many dramas, but adapted a number of plays from the German and French. Among his productions are "Her Great Match," "Nathan Hale," "The Masked Ball," "The Moth and the Flame," "The Cowboy and the Lady," "The Last of the Dandies," "Her Own Way," "The Woman in the Case," "The Way of the World," and "Captain Jinks of the Horse Marines." He died Sept. 4, 1909.

FITCHBURG, a city and one of the county seats of Worcester County, Massachusetts, on the Nashua River, fifty miles northwest of Boston. It is on the Boston and Maine and the New York, New Haven and Hartford railroads. The public buildings include numerous churches, several high schools, a public library and art gallery, and a public hospital. Educational advancement is facilitated by a number of scientific societies. It is the seat of the Fitchburg State Normal School. Among the manufacturing establishments are iron foundries, machine shops, cotton, woolen, and flour mills, paper mills, shoe and shirt factories, and wood-turning establishments. The streets are finely paved, well lighted, and connected with suburban districts by electric car lines. It has a growing trade in merchandising and farm produce. Fitchburg was settled in 1719, was a part of Lunenburg until 1764, and was incorporated as a city in 1872. Population, 1905, 33,017; in 1925, 43,609.

FITCHETT, William Henry, journalist and author, born in Lincolnshire, England, in 1836. He was educated at the Melbourne University and entered the ministry. His able pulpit oratory and devoted Christian life caused his rapid promotion to positions of responsibility, and he was for some time president of the general conference of the Methodist Church in Australia. He published several magazines and was for a time editor of a daily newspaper in Melbourne, where he was president a number of years of the Methodist Ladies' College. His publications include "Fights for the Flag," "Deeds That Won the Empire," "Nelson and His Captains," "Life of Wesley," and "Unrealized Logic of Religions."

FITZGERALD, county seat of Ben Hill County, Georgia, on the Seaboard Air Line and other railroads. The surrounding country is agricultural. It has railroad shops, foundries, and a brisk trade. The features include the high school, courthouse, and city hall. It was incorporated in 1897. Population, 1920, 6,870.

FITZGERALD (fĭts-gĕr'ạld), **Edward,** poet, born near Woodbridge, England, Mar. 31, 1809; died June 14, 1883. His wide reading caused him to be attracted to Spanish and Persian literature. This bore fruit in his translations of "Six Dramas of Calderon." In 1859 he published his translation of "Rubáiyát," written by Omar Khayyám. The last mentioned is his greatest work and went through many editions.

FIUME (fē-o͞o'mȧ), a seaport of Jugo-Slavia, on the Adriatic Sea, at the mouth of the Fiumara River. It has a fine harbor on the Gulf of Quarnero and has convenient railroad facilities. The manufactures include paper, tobacco, machinery, soap and clothing. Among the principal buildings are a municipal theater, a naval academy, the town hall, and the Church of Saint Vitus. It has a large interior and foreign trade. Fiume was a town of the Byzantine Empire. It became a possession of Austria in 1471, and in 1779 was made a part of Hungary. Fiume was a point of contention at the Paris Peace Congress in 1919, when both Italy and the Jugo-Slavs laid claim to it by force of arms. As a matter of settlement it was made a free port. Population, 1919, 41,287.

FIVE FORKS, the site of a battle fought in Dinwiddie County, Virginia, April 1, 1865. It was Grant's intention to cut General Lee off from Petersburg, and he accordingly dispatched Sheridan with cavalry and Warren with infantry to the extreme left, where Lee had stationed Pickett. Sheridan attacked the intrenchments at Five Forks held by Pickett's corps, but was driven back. On the next day he was reinforced by Warren's corps and carried the fortifications, taking 5,000 prisoners. The Union loss was 1,000 men. As a result Petersburg evacuated on April 2, and Richmond fell soon after.

FIVE NATIONS. See **Iroquois.**

FIXED STARS. See **Stars.**

FLAG, a banner used as a mark of distinction by a company, party, sovereign, or nation. It consists of a piece of cloth, usually

square, oblong, or triangular. The material is commonly of bunting, either plain or bearing a device, and is displayed as a standard, symbol, or signal by being attached by one edge to a staff, or to a halyard, by which it may be hoisted on a pole. The Egyptians originated the idea of standards early in their history, which is verified by inscriptions on very ancient sculptures and temples. That the Greeks and Romans followed by the adoption of standards and ensigns is clearly borne out by the *gonfalon,* which was borne in the Roman army near the commander in chief during an engagement. In the Middle Ages the *pennon* was used by a knight, while the *standard* served the purpose of distinguished persons. The cross appeared in the banners of the Crusaders during their historic upheavals in mediaeval European history.

The flag of Denmark is the oldest among European standards. It is red with a white cross and dates from the 13th century. The union of the three crosses of Saint George, Saint Andrew, and Saint Patrick first designated the union of Scotland with the kingdom of Great Britain, and later it symbolized the union of this kingdom with Ireland. It is known as the *union jack,* which at present constitutes the naval flag. In the British flag is a quartered field, one quarter blue, one quarter yellow, and two quarters red, which bears the insignia of Ireland, Scotland, and England.

The imperial flag of the German Empire is yellow, containing in the center the imperial arms and a gold shield. It is divided into quarters by the iron cross, three black eagles and the crown appearing on each of them. The Turkish Empire has a red flag, with eight pointed stars and a crescent moon; the latter became historic in distinction from the cross of the Crusaders. Russia has a yellow flag, on which the Russian arms are conspicuously displayed, but its naval flag is white with diagonal bars of blue. All nations and many sovereigns, states, principalities, and provinces have flags appropriate to their purpose, usually bearing a more or less decorative field in commemoration of some historic event.

Flags are borne on the masts of ships to designate the country to which they belong and to indicate the rank of the commanding officer. The regiments of an army are distinguished from each other by the flags they bear. A yellow flag borne on a vessel denotes quarantine and a red flag, that powder has been taken on board. A white flag is by the consent of all nations a flag of truce, and a vessel bearing such a flag is met by a vessel or boat under charge of a commissioned officer bearing a white flag. When a flag is lowered or hoisted to half the height of the staff on land or to half the mast of a ship, it indicates mourning. A flag is lowered or is pulled down as a mark of respect for a superior officer. To indicate distress, it is reversed. Aside from their use as emblems and to designate certain officers, flags serve an important purpose in mercantile and national navies as signals by which to communicate. They are used extensively for weather, railway, survey, and other signals.

In America the Colonies used the British flag prior to the separation from England, though several others had been proposed early in the agitation for separation. The first was one bearing the inscription "Join, or die," and, when the purposes of resistance to the British began to assert themselves more forcibly, a flag bearing a rattlesnake was designed. It bore the motto "Don't tread on me." However, Canada continues to use the imperial flag of Great Britain, but it also has a banner of its own, the Federal flag of Canada. See **Canada.**

The present national flag of the United States, called the *stars and stripes,* originated June 14, 1777, when the Continental Congress resolved that "the flag of the United States be thirteen stripes, alternate red and white, and that the union be thirteen white stars on a blue field." Congress changed the flag to fifteen red and white stripes and fifteen stars in 1794, but in 1818 an act was passed by which the original thirteen stripes and fifteen stars were restored, as the addition of a new stripe for each additional State would make the flag unwieldy. At that time it was provided that the thirteen horizontal stripes, which represent the thirteen original states, should be continued, while a new star should be added to the number with the admission of a new State into the Union, the addition to take effect on the Fourth of July next succeeding the admission. The first flag under this law was hoisted over the Capitol of the United States in 1818. It remains unchanged, except as to the number of stars. The last addition of stars was made in 1912, when Arizona and New Mexico were admitted into the Union.

FLAGELLANTS (flăj'ĕl-lants), a class of Christians which originated about the year 900, who thought that flagellation is a reasonable penance. It was recommended by the abbot of Prüm, in Rhenish Prussia, about that time, but did not become popular until 1260, when it came into prominence in connection with the struggle between the Guelphs and the Ghibellines. The second outbreak occurred in 1349, when the black plague was raging in Europe, and a third movement took place in 1414, at which time many became dissatisfied with the rule of the popes. The Flagellants enrolled for a period of 34 days; that is, one day for each year Christ lived on earth. They were stripped to the waist and scourged themselves with knotted whips as they marched from place to place, carrying banners and singing songs of praise. When blood was drawn as the result of flagellation, it was thought to atone for their own and others' sins. Since they belonged to the party of the Guelphs, they were

permitted to continue their practices by the Pope, but in 1349 Clement VI. issued a bull against them. Gregory VI. designated them as heretics in 1372, because they were said to consider flagellation more important than the sacraments. This sect had adherents throughout Western Europe, extending from Italy to Denmark and England.

FLAGEOLET (flăj'ō-lĕt), a wind instrument with a mouthpiece like a common whistle. It resembles the flute and is usually made of boxwood or ivory. Most instruments of this class are provided with a large aperture near the mouthpiece and six or more finger holes. The range is two octaves and the tone resembles that of the piccolo, but is softer in quality. *Flageolet tones* is the name given to the harmonic notes of the violin, violoncello, and other stringed instruments, which notes are produced by lightly touching the strings with the finger, thus producing a node, the string vibrating on both sides of the finger. See **Harmonics.**

FLAG OFFICER, a term used to designate a naval officer of rank high enough to command a fleet, or a subdivision of a fleet. Such an officer carries at the masthead a flag instead of a pennant, and is the naval equivalent of the general officer in the military. The vessel of the flag officer is called the *flagship.*

FLAG OF TRUCE, a signal that one of two contending naval or military forces desires to suspend hostilities. The flag used for such a purpose is white, and indicates that the party displaying it wishes to communicate or surrender. Firing upon a flag of truce is a breach of the naval or military code, and such an offense subjects the guilty party to severe retaliation and punishment. A flag of truce is sent by the senior officer to one of like rank, but the party who is to receive it may refuse acceptance, and the party bearing it may be warned not to proceed farther by a shot fired across the bow. A failure to stop when thus warned renders the party liable to be fired upon. A flag of truce is not permitted to be used to obtain private information, but serves only as a signal that the party displaying it desires to communicate.

FLAGSTONE, or **Flag,** the name of any rock that splits into tubular masses or flags, suitable for curbing, sidewalks, or doorsteps. Flagstones may be obtained from a variety of rocks, such as sandstone, limestone, and brownstone. A class of sandstone of the Devonian age yields bluestone which is well adapted for paving purposes.

FLAMBOYANT (flăm-boi'ạnt), in architecture, a showy style of decoration used extensively in the 15th century. It originated in France and is a form of Gothic architecture. Its realistic and pictorial treatment of decorative sculpture corresponds to the Perpendicular style used in England about the same time. The windows and panels are distinguished by flamelike tracery. The masterpieces of this style include the choir of Saint Séverin in Paris and the façades of the cathedral in Rouen.

FLAME, Temperature of, the condition, with respect to heat, of a blaze rising from a burning body. A flame usually consists of several parts which differ from each other in temperature as well as in color and illuminating power. The flame of a lighting device, such as a lamp or a gas jet, consists of an inner dark cone and a brilliant white envelope. In the center there is no combustion, hence the dark part of the flame, and the heat and the illuminating power are greatest where the combustion is most complete. The temperature of flames is a subject to which Rossetti gave much thought in 1878. After conducting careful investigations with his calorimeter, he announced the following table of results:

Locatelli lamp	1,688° Fahr.
Stearin candle	1,724° Fahr.
Petroleum lamp, with chimney	1,886° Fahr.
Petroleum lamp, without chimney—	
Illuminating part	1,688° Fahr.
Sooty envelope	1,436° Fahr.
Alcohol lamp	2,147° Fahr.
Bunsen burner	2,480° Fahr.

The temperature of an electric arc, as determined by Violle, is about 6,332° Fahr.

FLAMINGO (flă-mĭn'gō), a genus of migratory birds which until recently were placed among the waders, but they are now generally classed among the swimmers. However, they very seldom use their webbed feet for swimming, the web formation being designed rather for support on the soft, muddy bottoms. The body is not large, but the long neck and legs permit them to stand from three and a half to four feet high. In many respects the bill resembles that of a duck, but it turns suddenly downward near the middle, the mandible being furnished with small toothlike edges, which serve to prevent the escape of crustaceans, mollusks, worms, fish, or seeds, the common food. Flamingoes are birds of powerful wings and fly either in single file or in wedge-shaped flocks like geese, a single bird leading the way for the flock. The prevailing color is pinkish or reddish. The nest is made of mud scraped into a mound with the feet and hollowed out on top, in which two or three white eggs are laid and hatched, the young reaching maturity in about a year. Flamingoes inhabit Eurasia, Africa, and America. When feeding, they keep their feet continually going to stir up the mud. Some of the older birds act as sentinels for security to the rest. See illustration on following page.

FLAMINIAN WAY (flă-mĭn'ĭ-ạn), the chief road leading from ancient Rome to the northern provinces, so named from Caius Flaminius the Elder. It was platted to Arminium by Flaminius in 220 B. C., at the time he was censor, and subsequently branches were

laid out to all the important towns in the northern part of Italy. The length of the main road was 222 miles, which distance included many large grades and substantial bridges, remains of which are still found at some places.

FLAMMARION (flă-mà-rĕ-ôn'), **Camille,** noted astronomer, born in Montigney-le-Roi, France, Feb. 15, 1842. In 1858 he entered the Paris observatory, and soon after became distinguished as a lecturer on astronomy. He was selected as editor of the *Cosmos* in 1862. After 1865 he devoted his time largely to the publication of books and as scientific editor of the *Siècle.* For the purpose of studying aërial phenomena, he made numerous balloon ascensions, and in 1892 published an elaborate treatise on the theory that communication between the earth and planets which are nearest us is not impossible. Among his works are

FLAMINGO.

"Studies and Lectures on Astronomy," "Marvels of the Heavens," "Stars and Curiosities of the Heavens," "God in Nature," "Plurality of the Inhabited Worlds," and "Imaginary and Real Worlds." He died June 4, 1925.

FLANDERS (flăn'dĕrz), the former name of a region of Europe, extending along the German Ocean. It is now included in Belgium, Holland, and France, forming the provinces of East and West Flanders, in Belgium; the southern part of Zealand, in Holland; and all of Le Nord, in France. The original inhabitants were Belgic tribes, who were subdued by Caesar, and the region was added to Roman Gaul. Later it came into the possession of the Franks and was added to Neustria by the Treaty of Verdun. Philip the Bold erected the territory into a government district in the 9th century and assigned it to his son-in-law, Count Baldwin I. In 1016 the town of Valenciennes was added and Ghent and the Zealand Islands became a part of the district about the same time. Hainaut, Alost, and Tournai were added in the reign of Baldwin V., after whose death the region was divided and passed consecutively to various countries.

In the 12th century the manufactures and commerce of Flanders rose to vast importance, and in the former part of the 14th century the Flemings were able to contest successfully with France. The latter country resigned its claims to Flanders in 1526. Afterward it passed to the united houses of Austria and Spain, though Charles V. of Germany ultimately secured control of the larger portion. A part was united with the Netherlands by the Treaty of Westphalia, and other portions to France by the Treaty of the Pyrenees in 1659, the Treaty of Nimeguen in 1678, and the Treaty of Utrecht in 1713. The other portions then remaining independent now form the provinces of East and West Flanders in Belgium.

East Flanders has an area of 1,158 square miles and, in 1922, had a population of 1,052,970. The area of West Flanders is 1,249 square miles and the population, in 1922, was 812,962. Ghent is the capital of the former and Bruges of the latter. The soil is productive and carefully cultivated, while the manufactures of the various products, such as laces, linens, and damasks, excel in quality. Both provinces have extensive communication by canals, electric railways, and steam railroads.

FLANDRIN (flän-drăn'), **Jean Hippolyte,** painter, born in Lyons, France, May 23, 1809; died in Rome, March 21, 1864. He ranks as the most renowned French historical and religious painter of the last century, and decorated numerous churches in France in 1842-45. Among his most noted productions are "Saint Clair of Nantes," "Christ Going Up to Calvary," and "Christ Entering Jerusalem." The last mentioned is at the Parisian Church of Saint Germain.

FLANNEL (flăn'nĕl), a woolen fabric differing from broadcloth and cashmere in being woven of yarn which is twisted more loosely. It varies in degree of fineness, and is used very extensively for shirts and undergarments. By allowing the perspiration easy passage and not appearing cold to the body, if damp, it is cooler in summer and warmer in winter than other fabrics. A class of loosely woven fabrics made of cotton are known as *outing flannels.* They have a napped face and many of the designs are colored attractively. Another class, the *domett flannels,* are made with cotton warp and woolen filling.

FLATFISH, the common name of all fishes that swim on their side, such as the sole,

flounder, turbot, plaice, and halibut. The body is much compressed. The side which is turned toward the bottom is generally colorless. It is called the blind side, from the absence of an eye, since both eyes are on the upper side of the head. Some flatfishes have the right and others the left side turned toward the bottom.

FLATHEAD, the name applied to various Indian tribes, owing to their custom of flattening the skulls of infants by pressure. This practice was common to the fish-eating Chinook Indians on the Pacific coast; to the ancient natives of Peru, both previous and subsequent to occupation by the Incas; among the Caribs of Florida and Central America; and, it is thought, among the mound builders of the Mississippi valley. The civilized Selish Indians are improperly called Flatheads, as they do not flatten the skulls of their children. They originally inhabited the valley of the Saint Mary's River, but conveyed their lands to the United States, and were removed to Idaho in 1871, where they occupied the Jocko reservation. They always were peaceable and are now advanced in education and the industries.

FLAX, an annual plant with alternate linear-lanceolate leaves, many-flowered broad cymes, usually yellow, blue, or white, and crenulate petals. It embraces about a hundred species, which grow more or less widely distributed in all warm and temperate climates. A large yield is reported in the United States, where, in 1917, the product was 25,862,000 bushels. More than one-half of the crop was grown in North Dakota. The States which ranked next are Minnesota and South Dakota. Other regions which produce large quantities of flax are Manitoba, Saskatchewan, Argentina, Russia, India, and Austria. However, Argentina generally takes the first rank in the production of flaxseed, while Russia is the leading flax fiber producing country in the world. Flax is grown very extensively, on account of the commercial value of the seed as well as for its fiber. In most countries the virgin soil, when first broken, produces the best yield of flax. The ground is plowed in autumn or in the spring, depending upon the locality, and the seed is sown either in drills or broadcast, usually in April. When the crop is ripe, generally in August, it is cut with a harvester and is afterward thrashed with a machine to obtain the seed.

A large amount of labor is required to secure the fibers in the best condition. For this purpose the crop is usually pulled up by hand, roots and all, and the seeds are removed by a process called *rippling.* To obtain the *lint,* or flaxen fiber, from the *boon,* or core, of the stem, the bundles are steeped in water until the boon begins to rot, when it can be separated readily from the fiber by means of a *scutching blade* or a machine. It is next *hackled,* or combed, after which it is spun into threads and woven into cloth. Linseed oil is pressed from the seed, and the residue is a highly fattening food for hogs and cattle.

FLAX.
a, Flower; *b,* Seed Pod.

Flax was cultivated extensively in ancient times, both in Egypt and Asia, and linen is spoken of in the Book of Joshua. See **Linen, Linseed Oil.**

FLAXMAN (flăks'mạn), **John,** distinguished sculptor, born in York, England, July 6, 1755; died Dec. 9, 1826. He entered the Royal Academy as a student in 1770, where he later made models and designs for the potter, Josiah Wedgwood (1730-1795), and in the same year won a silver medal. He went to Rome in 1787, where he studied seven years and produced numerous designs to illustrate Dante, Homer, and Aeschylus. In 1794 he returned to London and three years later was elected an associate of the Royal Academy. In 1800 he became a royal academician. Among his numerous productions is a fine monument in Westminster Abbey built to Lord Mansfield. The Royal Academy appointed him professor of sculpture in 1810.

FLEA (flē), a wingless insect, belonging to the hopping Diptera. It has two lancetlike mandibles, a sucker, and a slender, bristlelike tongue, the whole incased between two three-jointed plates. The entire body is covered with a tough integument. It is very ac-

tive and can leap two hundred times its length in a single bound. The common flea thrives particularly in the nests of poultry and on the fowls themselves. Some species infest the furs of animals and often prey upon man. In favorable weather fleas hatch in five or six days, in about twelve days they inclose themselves in a cocoon, and after eleven days more come out perfect insects. They are

DOG FLEA. COMMON FLEA. *a*, proboscis.

most numerous in dry climates and in filthy and uncouth places.

FLEABANE (flē'bān), the name of several species of plants, widely distributed in all the continents. The common fleabane of England grows to a height of fifteen inches, has panicled flowers, and is used in treating diarrhoea and dysentery. A species native to California yields ingredients useful in manufacturing the Persian insect powder and is recommended for its medicinal properties. Horseweed, butterweed, and sweet scabious are names applied to species found in the Mississippi Valley, especially in the northeastern section.

FLEMING (flĕm'ĭng), **Sir Sanford,** surveyor, born at Kirkcaldy, Scotland, Jan. 7, 1827. He studied in his native country and came to Canada in 1845, where he took up the work of an engineer on the Northern Railway. Later he was sent as commissioner to the Red River of the North to ascertain the advisibility of connecting it with the eastern part of Canada, and in 1871 began the survey for the Canadian Pacific Railway. In 1880 he was made chancellor of Queen's University, founded the Canadian Institute, and in 1888 was president of the Royal Society of Canada. He published "A Cable Across the Pacific," "Uniform Standard Time," and "The Prime Meridian Question." He died July 22, 1915.

FLEMISH (flĕm'ĭsh), the language spoken in a number of Belgian provinces, portions of Holland and France, and several countries adjacent to these. It is a form of Low German, or *Platt-Deutsch,* and differs but slightly from the German in pronunciation and orthography. In East and West Flanders, Limburg, Antwerp, and Brabant it is the universal tongue and gives evidence of but little change in dialect since the 8th century. The language spoken is very similar to the form of speech used by the Council of Liptines in 742, while preparing a creed in which pagans renounced idolatry when they embraced the Christian faith.

The Flemish literature is comparatively modern, and before the 19th century it was identical with the Dutch. However, some of the early writers of the literature which belongs to the Netherlands may be said to have laid a distinct foundation for the Flemish of modern times. Jakob Van Maerlant is regarded the father of Flemish poetry. He wrote several romances in which he treats the "Holy Grail," while "Reynard the Fox" and the "Mirror of History" were produced in the same period. In 1618 a translation of the Bible was made into the Flemish. It contains such elegance of expression that it is regarded the standard authority in orthography and construction. French ascendency tended to limit the language and literature, but after the revolution of 1830 it began to revive and take on its present form. Among the noted leaders in the revival of Flemish may be named Blommaert, Conscience, Van Duyse, Snieders, DeVries, Willems, Van Rijswijk, David Bormans, Willem Bilderdijk (1756-1831), and Snellaert.

FLENSBURG (flĕns'bo͝org), a city of Germany, in the province of Schleswig-Holstein, about forty miles northwest of Kiel. It is located on the Flensburg Fiord of the Baltic Sea and has railroad and electric railway facilities. The chief buildings include a courthouse, a theater, a public library, and the Marienkirche. Among the manufactures are carpets, oil, machinery, clothing, and sailing vessels. It has a large trade in coffee, grain, and live stock. Flensburg was founded in the 12th century. Population, 1920, 60,931.

FLEUR-DE-LIS (flēr-dẹ-lē'). See **Iris.**

FLEURY (flē-rē'), **André Hercule de,** cardinal, born at Lodève, France, June 22, 1653; died Jan. 29, 1743. He studied at Paris, entered the church, and in 1698 was made Bishop of Fréjus. In 1715 he became tutor to the young Louis XV., who was then five years of age, and when the latter ascended the throne Fleury was made a member of the council of state. He was raised to the dignity of cardinal in 1726, when he virtually became prime minister. He favored peace, reduced the expenses of the government and promoted a policy of internal improvement. The Bibliothèque Nationale at Paris was completed during his administration.

FLICKER (flĭk'ẽr), the popular name for the golden-winged woodpecker, a beautiful bird common to the eastern part of Canada and the United States. It is about a foot in length, has an olive-brown color, with black and white markings, and the head and neck are ash-colored. It winters in the southern part of the United States, moving northward on the early approach of spring. The food consists of worms and insects, which it extracts from the trees, but it also feeds on ber-

ries and the tender parts of plants. A large number of species of the flicker have been listed, including about 35. The *red-shafted flicker* is common to the region west of the Rocky Mountains, from Mexico to Alaska. *Yellow-hammer, sap-sucker,* and *high-holder* are other names locally applied to birds of this class.

FLINT, a mineral regarded as a species of quartz, or as intermediate between quartz and opal, consisting almost entirely of silica. It has slight traces of oxide of iron, lime, and carbon, and contains some organic matter. Flint is usually gray, smoke-brown, or brownish-black, but is sometimes spotted or mottled. Dark-colored varieties are usually found imbedded in chalk and are abundant wherever chalk formations prevail. Flint, when struck with steel, produces a spark of fire, which property was formerly made use of in firearms and for starting fires. Knives, axes, arrowheads, and various sharp weapons and cutting instruments are among the most interesting relics of antiquity.

FLINT, a river of Georgia, rises in Clayton County, and flows by an irregular course to the southwest corner of the State, where it joins the Chattahoochee to form the Apalachicola River. The entire course of 300 miles is through a rich agricultural and mineral country. Light-draft steamers navigate it as far as Albany, a distance of about 140 miles from its mouth. Larger steamers reach Bainbridge, a distance of 50 miles.

FLINT, a city of Michigan, county seat of Genesee County, on the Flint River, about sixty miles northwest of Detroit. It is on the Père Marquette and the Grand Trunk railroads. Electric car lines, waterworks telephones, pavements, and electric lighting are among the municipal facilities. It has a fine courthouse, a public library, and a commodious high school building. It is the seat of Oak Grove Home, an institution for the feebleminded, and of the State institution for the deaf and dumb. The principal manufactures include automobiles, woolen goods, flour, machinery, cigars, clothing, and utensils. The surrounding country produces large quantities of cereals and fruits. Flint was settled in 1820 and incorporated as a city in 1855. Population, 1904, 14,884; in 1920, 91,599.

FLINT, Austin, physician, born in North Hampton, Mass., March 28, 1836. His father, Austin Flint, Sr. (1812-1886), was a successful physician and gave the son the advantages of a thorough education. He studied medicine at Jefferson Medical College, Philadelphia, and began a successful practice in Buffalo in 1857. In the meantime he was professor of physiology and anatomy in the University of Buffalo. In 1859 he located in New York City, the following year was chosen professor of physiology in the New Orleans Medical College, and subsequently studied in Europe. He was professor of anatomy and physiology in Bellevue Hospital Medical College from 1861 until that institution was affiliated with the New York University, in 1898, and that year became professor of physiology in Cornell University Medical College. His experimental investigations resulted in numerous discoveries, among them several relating to the function of the liver and the constituents of the bile. He contributed to medical literature and was long an influential member of many medical and scientific societies. Among his publications are "Effects of Severe and Prolonged Muscular Exercises," "Physiology of Man," "Physiology of the Nerves," "Treatment of Diabetes Mellitus," "Manual of Chemical Examination of the Urine in Disease," and "Experiments Regarding a New Function of the Liver, Separating the Cholesterin of the Blood and Eliminating it as Stercorin." He died Sept. 23, 1915.

FLINT GLASS. See **Glass.**

FLINT IMPLEMENTS, the utensils formerly used in performing manual labor and as instruments of war. Specimens are found frequently in the places which were occupied by settlements in prehistoric ages. While they occur in all regions where settlements were maintained in early times, they are met with most numerously in European countries, particularly in Denmark, the Netherlands, and other regions of the northern and western parts of Europe. These implements consist of chisels, knives, daggers, saws, scrapers, arrowheads, axes, and borers, and served a useful purpose, though modern savages do not employ such tools. The American Indians made arrowheads and other instruments of flint, many specimens occurring in different sections of America, but they are more abundant in the Mississippi valley than elsewhere.

FLINTLOCK, a small gun originated by the Spaniards in the 17th century. It has a small piece of flint in the jaw of the hammer, which, when released, strikes a piece of steel, and the sparks ignite and explode the charge. William III. introduced flintlock muskets into England, where various forms of this class of firearms continued in use until about 1840. Arms of this kind formerly were used both in war and in sporting, but they have been superseded by modern weapons, such as breech-loading guns and rifles.

FLOATING ISLANDS, the formations caused in lakes and other inland waters by the aggregation of driftwood carried down by rivers, and by deposits of soil and vegetable matter, or by detachments of elevations adjacent to the banks of rivers or on shores of lakes. These islands occur more numerously

in tropical countries and receive their early consistency by interlacing roots of plants, and later by the growth of shrubs and even trees. Some of the islands are large enough to furnish pasturage and are met with from fifty to a hundred miles from the mouths of the large rivers of Asia, Africa, and America.

FLODDEN (flŏd'dẹn), **Battle of,** a severe military contest that occurred on Flodden Hill, Scotland, Sept. 9, 1513, between the English army commanded by the Earl of Surrey and the forces of James IV. of Scotland, in which the latter were defeated. The English army consisted of 32,000 men and the Scottish of 30,000. Both sides lost heavily. The English army lost 4,000, while the loss of the Scots was much heavier and included several earls and other officers of high rank. A description of the battle is given in Sir Walter Scott's "Marmion."

FLOOD PLAIN, a level tract of land on the border of a river, formed by sand and silt deposited during overflows. In many places the surface is highest near the margin of the river bank, where the greater amount of silt is deposited during an overflow, and some distance back are marshes and swamps, which are sometimes fed by springs or remain wet for want of sufficient drainage. The flood plains in the lower course of the Mississippi are very fertile. Formerly they were covered by meadows or swampy forests, but now they yield large quantities of agricultural products. Other tracts of this kind are located on the middle course of the Rhine and Danube and on the lower course of the Nile, Po, and Ganges. See **Delta.**

FLORA (flō'rȧ), the goddess of flowers, who was held in the highest esteem by the Romans. Her festival, the Floralia, was celebrated from April 28 to the first of May. The festival was one of universal merriment, in which houses, streets, and vehicles were profusely decorated with flowers. Two temples were built at Rome to this deity. She typified the season of spring, and was the reputed guardian and protectress of every blossom.

FLORENCE (flŏr'ẹns), county seat of Lauderdale County, Alabama, on the Tennessee River, 126 miles southwest of Nashville, Tenn. It is on the Southern and the Louisville and Nashville railroads, at the foot of the Muscle Shoals Canal, and is surrounded by a fertile agricultural and fruit-growing country. The noteworthy buildings include the county courthouse, the public high school, a State normal school, an academy, the Synodical Female College, and the Southern University for Women. Wildwood Park is a fine public resort. Among the manufactured products are cotton goods, cigars, machinery, vehicles, and building material. Near the city is one of the largest Indian mounds in the State. Coal deposits abound in the vicinity. Florence was settled in 1819 and incorporated in 1889. Population, 1900, 6,478; in 1920, 10,529.

FLORENCE, county seat of Florence County, South Carolina, 82 miles northeast of Columbia, on the Atlantic Coast Line and other railways. It has a large trade in cotton, tobacco, and merchandise. The features include the courthouse, high school, Y. M. C. A., city hall, and federal building. It has manufactures of tobacco, plows, bridges, machinery, and cotton products. Population, 1920, 10,968.

FLORENCE, a city of Italy, capital of a province of the same name, on the Armo River, about 140 miles northwest of Rome. It takes high rank in the manufacture of woolen and silk goods, porcelain, mosaic, hats, musical instruments, toys, and objects in the fine arts.

The public buildings include several beautiful palaces and impressive structures, and many piazzas or squares give the city a reputation for elegance and convenience. Among the principal buildings is the cathedral founded in 1298, and dedicated with much display and impressive ceremonies in 1887. Michael Angelo found the dome of this historic structure a convenient model for Saint Peter's. In the cathedral are numerous sculptures by master artists, among them Michael Angelo. Other churches contain almost an equal wealth of master productions in sculpture and painting. The celebrated buildings include the Uffizi, Vecchio, Signoria, Pitti, Strozzi, Il Bargello, and Riccardi palaces. The cathedral of Santa Maria del Fiore is the most remarkable building in the city. Many eminent Tuscans were buried in the church of Santa Croce, which has many fine decorations and celebrated tombs, among them those of Galileo, Michael Angelo, Alfieri, and Machiavelli. Dante's monument by Piazzi is situated in the Piazzi Santa Croce. A national library of more than 200,000 volumes and 12,000 manuscripts is located in the Pitti Palace, which also contains the celebrated Florentine gallery of art. Florence has numerous literary and educational establishments, a public school system, and institutions devoted to the arts, sciences, and higher educational interests. The Florence school of art is the most important in Italy.

Florence was founded by the Romans in the 1st century B. C., and probably named from Fiesole, a beautiful mountain near its site. It came under the dominion of Pope Gregory VII. in the 11th century, and by the middle of the 13th century it rose to commercial importance, ranking for many years as one of the first cities of Italy. An independent republic was established at Florence in 1283, and about fifteen years later great strife arose between rival parties under the names of Blacks (Ghibellines) and Whites (Guelphs), which resulted in the

defeat of the latter and the banishment of the leading members, among them the poet Dante. The republic fell in the 16th century and it was placed under Charles V. of Germany, who became known as the Duke of Florence, and was a member of the Medici. This dynasty ruled until 1737, when it was succeeded by Francis of Lorraine, who afterward became Emperor of Germany. The history of Florence is merged into that of Tuscany from that time until it became united with the kingdom of Italy. From 1864 to 1871 it was the provisional capital of the kingdom, whence dates its recent prosperity. Among the great men produced by Florence are Amerigo Vespucci, Galileo, Dante, Boccaccio, Michael Angelo, Vinci, Cellini, Andrea del Sarto, Medici, Machiavelli, and Petrarch. Population, 1922, 242,-308.

FLORICULTURE (flō'rĭ-kŭl-tûr), the cultivation of flowers or ornamental plants. While this branch of the industries has been carried on in Eurasia from remote ages, it is of comparatively recent date in America, and has been pursued as a business only about a century. In 1890 the government census detailed the first general information in regard to floriculture in the United States, but much of material value was added by subsequent census investigations. The number of floral establishments in 1926 was about 12,125, of which 780 were operated by women. Establishments of this kind are operated in all the states, about 1,500 acres of land are utilized for the purpose, and the value of the annual output is $42,250,000. Employment is given to about 32,500 men and women. The states of New Jersey, New York, and Pennsylvania take the leading rank in floriculture. Ontario and Quebec are the leading provinces in the floriculture of Canada. Among the products are cut flowers, rose bushes, plants, and shrubs. Roses, carnations, violets, chrysanthemums, and lilies are the leading flowers sold on the market, in the order named.

FLORIDA (flŏr'ĭ-dȧ), a southern State of the United States, popularly called the Everglades State. It is bounded on the north by Alabama and Georgia, east by the Atlantic Ocean, and south and west by the Gulf of Mexico, and west by Alabama. The larger part of the State is a peninsula, extending about 400 miles south from Georgia, the remainder being a narrow strip of land, the western point of which lies 350 miles west from the Atlantic Ocean. The western boundary is formed by the Perdido River, which enters the Gulf of Mexico at Perdido Point. About four-fifths of the State is contained in the peninsula. The area is 58,680 square miles, including a water surface of 4,440 square miles.

Description. The southern portion is generally low and marshy, while the northern part is more elevated and somewhat broken, though no part of it rises to a greater altitude than 300 feet above the sea. At Key Biscayne is the northern extremity of the Florida Keys, which stretch toward the southwest in a curved line about 200 miles. They consist of coral reefs and include a number of habitable islands, the surface of which is about ten feet above sea level. The Dry Tortugas, Key Large, and Key West are the larger of these islands. Among the larger coast indentations are Apalachee Bay, Tampa Bay, Biscayne Bay, Charlotte Harbor, Choctawhatchee Bay, and Pensacola Bay. The Atlantic coast line is about 470 miles and the coast of the Gulf of Mexico is 675 miles long.

Florida has about 5,000 lakes, most of which are located in the peninsula. Lake Okeechobee, with an area of 650 square miles, is the largest of the lakes. Others include lakes George, Apopka, Harris, and Kissimmee. The Saint Mary's River forms a part of the boundary between Florida and Georgia, and the Saint John's has its outlet into the Atlantic. Lake Okeechobee is drained by the Caloosahatchee, which flows into the Gulf of Mexico. The Peace flows into Charlotte Harbor; the Apalachicola and Suwanee, into the Gulf; the Choctawhatchee, into Choctawhatchee Bay; and the Escambia, into Pensacola Bay. The rivers have about 1,000 miles of navigable water.

Climate. Its favorable situation between the temperate and tropical regions gives Florida an equable and agreeable climate. The freezing point is rarely reached, while the wholesome influences of the gulf and oceanic waters modify the climate agreeably during the warmer parts of the year. About 43° to 90° include the limits, though the temperature sometimes falls below 32° for brief periods in the northern part. The average annual temperature at Jacksonville is 69°; at Key West, 78°; and at Pensacola, 68°. In the swamp region the climate is unhealthful, but statistics accord the other parts of the State a very high position in the record of favorable climate, which fact is utilized by many invalids of the north, who seek a genial and healthful region during the winter season. St. Petersburg, Tampa, Sarasota, Miami, Hollywood, and Tarpon Springs are noted winter resorts. Copious rains fall during the summer, while the winters are characterized by moderately dry, but agreeable and favorable, conditions. In some places the rainfall is 60 inches and at Jacksonville it is 54 inches.

Minerals. Metallic mines are not worked in the State. Phosphate rock is the most important mineral product and is mined extensively for the manufacture of fertilizers. Deposits of this mineral occur most extensively between Tallahassee and Lake Okeechobee. Limited quantities of lignite coal and petroleum are ob-

tained. Deposits of fuller's earth are worked in the vicinity of Quincy; kaolin is obtained in Lake and Putnam counties.

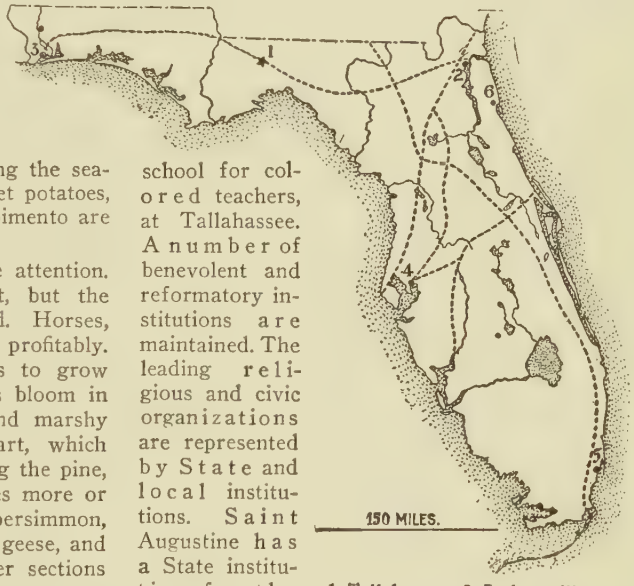
AGRICULTURE. Farming has increased constantly since the close of the Civil War and continues to rank as the leading industry. About one-third of the farmers are Negroes, who work tracts that average about half the size of those operated by the whites. A very limited proportion of the land in the Everglades has been brought into a state of cultivation, but large districts are subject to reclamation, and here the soil is exceeding fertile. The crops vary somewhat with location north and south. Orange culture has taken rank as an important industry and the State has about half the orange acreage of California. Corn is grown extensively in the northern part, and the last decade shows a considerable increase in the acreage of that cereal. Other crops include pecans, oats, potatoes, tobacco, arrowroot, cassava, and many varieties of fruit. Several species of cotton thrive, including the sea-island cotton. Sugar cane, hay, sweet potatoes, peanuts, pepper, ginger, cloves, and pimento are other products of utility.

Stock raising receives considerable attention. Cattle are grown chiefly for meat, but the dairying interests are well established. Horses, mules, swine, and sheep are grown profitably. The favorable climate causes plants to grow with vigor and rapidity, and flowers bloom in all seasons of the year. Grassy and marshy plains characterize the northern part, which has an abundance of timber, including the pine, live oak, and palmetto. Other species more or less distributed are the magnolia, persimmon, and pitch pine. Wild turkeys, ducks, geese, and partridges are abundant in the newer sections of the State.

MANUFACTURING. The manufacture of cigars and tobacco is an important industry, and a part of the raw material is imported from Cuba. Tar and turpentine are made for exportation. The fisheries yield a large output, especially of shad, mullet, and sponges, much of the product being prepared for the market. Fruit is canned to a considerable extent. Other manufactures include fertilizers, railway cars, canned fish, furniture, clothing, and lumber products.

COMMERCE AND TRANSPORTATION. The State has a large domestic and foreign trade, which centers chiefly at Tampa, Pensacola, Jacksonville, and Key West. Phosphate, cigars, fruit, vegetables, turpentine, fish, and forest products are among the chief articles of commerce. Tampa and Key West are especially noted for their large trade in cigars, while Carrabelle is important as a market for turpentine and Punta Gorda for fish and vegetables. Transportation is facilitated by 5,299 miles of railway, including the important line which extends to Key West. Many of the streams are navigable, which, together with navigation on the Atlantic and the Gulf, afford first-class facilities.

EDUCATION. Educationally, Florida is making material progress, its educational institutions being well established and liberally patronized. The common schools, high schools, and State institutions maintain well-articulated courses of study. The University of Florida is located at Gainesville; the State College for Women, at Tallahassee; the Stetson University, at Leland; the South Florida Military and Educational Institute, at Bartow; the West Florida Seminary, at Tallahassee; a State normal school for whites, at De Funiak; and a State normal school for colored teachers, at Tallahassee. A number of benevolent and reformatory institutions are maintained. The leading religious and civic organizations are represented by State and local institutions. Saint Augustine has a State institution for the blind and dumb and the State reformatory is at Marianna. School attendance has been increased materially by a process of transportation of the pupils, but the number of schools decreased somewhat.



1, Tallahassee; 2, Jacksonville; 3, Pensacola; 4, Tampa; 5, Miami; 6, Saint Augustine. Chief railroads are shown by dotted lines.

GOVERNMENT. The present constitution was ratified in 1886. It vests the chief executive power in the Governor, who is elected for four years and is not eligible to succeed himself. Other State officials, including the secretary, treasurer, attorney-general, comptroller, commissioner of agriculture, and superintendent of schools, are likewise elected for four years. The senate consists of 38 members elected for four years, and the general assembly has 91 members elected for two years. Legislative sessions are held biennially and are limited to sixty days. A chief justice and two associates, elected for six years, comprise the supreme

court, which is the tribunal of highest judicial power. The State is divided into circuits for judicial purposes, each having circuit judges. The towns, cities, and counties elect their respective officers, most of whom serve for terms of four years.

INHABITANTS. About eighty per cent. of the people reside in the country and in small towns. A large number belong to the Methodist church. The remainder are divided among the Baptists, Presbyterians, Protestant Episcopal, Catholic, and other denominations. Tallahassee, in the northern part of the State, is the capital. Other cities include, Jacksonville, Key West, Miami, St. Petersburg, Tampa, and Pensacola. The State has grown constantly since the Civil War, both in wealth and in the number of inhabitants. The total population, in 1900, was 528,542; in 1920, 966,296; in 1925, 1,263,549.

HISTORY. The history of Florida begins with its discovery by Ponce de Leon in 1512, while he was in search of a mythical fountain whose waters would confer perpetual youth. It was discovered on Easter Sunday, the *Pascua Florida* of the Spaniards, hence the name Florida. De Soto explored it in 1539. In 1560 the French Calvinists founded a settlement, but they were shortly after massacred by the Spaniards. The region remained in possession of Spain until 1763, when it was ceded to England in exchange for Cuba, though the Spaniards regained the country in 1781. The United States purchased Florida in 1819, but the treaty was not finally ratified until 1821, when it was organized as a Territory, and it was admitted as a State in 1845. This treaty relinquished all Spanish authority over the region west of the Rocky Mountains, claimed as belonging to the Louisiana Purchase, but not previously acknowledged by Spain. Many of the settlements were disturbed by the Seminole Indian wars in 1835-42, though these Indians were removed to Indian Territory, now Oklahoma, shortly after. In 1861 Florida seceded from the Union, but was readmitted under the reconstruction policy of President Johnson. The State was visited by a destructive hurricane in 1926, when many lives were lost and much property was damaged, especially on the eastern coast.

FLORIDA, Bay of, the name of the narrow channel between Florida and Cuba, lying west of the Bahama Islands. It is separated from Florida Bay by the Florida Keys, and is traversed by the Gulf Stream. It is about 60 miles long at the northern extremity and 130 miles at the southern, and has a length of 225 miles.

FLORIDA KEYS, a group or chain of islands at the southern extremity of Florida, belonging for the purpose of government to Monroe County. It stretches in a curved line fully 200 miles from Biscayne Bay toward the southwest into the Gulf of Mexico. The group includes thousands of islands, some of coral formation, and many are low, marshy, and uninhabitable. Key Largo is the largest, but Key West is the most important. The latter contains the city of Key West and a naval station.

FLORIDA KEYS, BAY OF FLORIDA, AND KEY WEST RAILROAD.

A railroad extends from the mainland across the principal chain of islets, connecting them by massive iron and concrete bridges.

FLORIN (flŏr'ĭn), a coin so named from Florence, Italy, where it was first issued in 1254. Coins of the same name and of different values have been issued in many countries. The *gulden,* originally issued in Germany, was until a comparatively recent time the monetary unit of Austria, and the *guilder* is still used in the Netherlands. A silver piece with a value of two shillings is in circulation in Great Britain, and bears the official name of *florin,* but the gold florin of England has not been issued since the Middle Ages. The English florin is worth here about 50 cents; the Dutch guilder, about 40 cents; and the German gulden about 35 cents.

FLOTOW (flō'tō), **Friedrich, Freiherr von,** musical composer, born at Teutendorf, in Mecklenburg, Germany, April 27, 1812; died in Weisbaden, Jan. 24, 1883. After attending the schools of his native town, he studied under Reicha in Paris, and attained a reputation by his early operas. He was appointed superintendent of the theater in Schwerin in 1856, where he attained much success, producing numerous operas and symphonies. In 1863 he resigned, after which he resided chiefly in Paris. Among his most celebrated compositions are "Alessandro Stradella," "Martha," and "Indra."

FLOTSAM (flŏt'sam), the name applied in the English law upon the goods that float upon the surface of the water after a shipwreck, or

such as are thrown overboard to lighten the cargo. They belong to the crown if they are not claimed by their owner after recovery. Goods that are cast from a ship in peril are sometimes called *jetsam,* and those that are tied to wood or a cask before being cast out are designated as *ligan.* These words are now seldom used, but the term *jettison* is employed in connection with insurance.

FLOUNDER (floun'dĕr), a genus of fishes of the flatfish family, found along the shores of almost all countries. The body is often a foot or more in length, extremely flattened at the sides, and about one-third as wide as it is long. Like other flatfish, they usually swim on the left side, but reversed specimens are common. About 150 species of the flounder have been studied, most of which occur in salt water, but several of the species thrive in lakes and other bodies of fresh water. The color varies according to the ground where the fish live. Flounders are excellent and favorite food fish.

FLOUR, the ground and bolted portions of cereals, though specifically applied only to the products made of wheat. When applied to the finely ground substance of any other cereal it is usually specified, as rye flour, buckwheat flour. Among the principal food products flour is of vastly greater importance than any other, and, as an edible substance, enters into manifold convenient forms, such as bread, biscuit, cake, pudding, and crackers. Rice being the favorite food of the Mongolians of Asia and entering quite largely the edible substances of other people, it is the only cereal that rivals flour as food for man. The cultivation of cereal plants is as old as the history of man, which likewise is true of the use of their seed for food.

Various relics of remote antiquity indicate that crude devices were employed in the manufacture of flour from wheat and rye. The process consisted of crushing the grains in a cavity cut in stone by means of a conical piece of porphyry, crystal, or marble. In the later period of ancient Egypt and the early times of Rome, the pestle and mortar served for crushing grain, which were soon displaced by the ox mill and later by the water mill. In early water mills the process of grinding was effected by an upper and lower millstone. The latter had a slightly convex surface, over which the concave surface of the former fitted. The grain passing between the two in a slow but constant stream was ground to a mixed mass of flour, middlings, and bran, each of which was afterward separated from the others. Modified forms of this class of mills are still used in newly settled countries and among people who do not manufacture vast quantities of flour.

In modern flour milling it is customary to convey the wheat from railway cars, in which it is shipped from the agricultural districts, into bins. From the bins it is carried by means of elevators into storage rooms at the top of the mill building, where it is kept until needed for grinding. The machinery for manufacturing flour is located usually on the first floor, and as the grain is let down all foreign matters are separated from it. In the cleaning process all the oats, chaff, dirt, dust, cockle, and other impurities are taken out by means of blasts of air, sieves, and powerful magnets, the latter removing all particles of iron that may have mixed with the grain in threshing and in transportation. After this process of cleaning, it passes consecutively between rollers or cylinders having spiral corrugations that operate to crush it. The first of these are coarse and serve to break the wheat into particles, but they become finer and are set more closely together until the last of the series effects a very high degree of crushing.

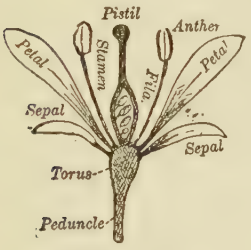
After the wheat is crushed sufficiently, the product is carried to complicated machinery in which the *flour, middlings,* and *bran* are separated. This machinery has been perfected to such a high state that remaining impurities can be removed and all portions of the wheat are utilized to the best purpose. Formerly the mills were somewhat unpleasant because of the flying particles of flour. However, this has been overcome by a dust collecting machine, which creates a vacuum through the agency of a fan, causing the suspended particles to be drawn by currents of air into a chamber, from which they are removed at certain intervals. Roller mills are now employed in manufacturing flour both from spring and winter wheat, and are propelled successfully by water, steam, or electric power, though the first named is far the most inexpensive.

About 18,500 flouring mills are operated in the United States. Those at Saint Anthony Falls, Minneapolis, are propelled by water power and are the largest in the world. Pennsylvania has the largest number of mills, though most of them are small. Canada holds the second rank in the list of North American countries as a producer of flour. The vast wheat fields of the central-western section have made this possible. Winnipeg is one of the great flour-producing cities of the world. Other centers are at Toronto, Ottawa, and Vancouver. A national association of millers is supported in the United States, which has numerous branches in the several states where milling is an important industry. With it are associated a number of mutual insurance companies. About 16,500,000 barrels of flour are exported from the United States annually, while the domestic market requires 75,500,000 barrels.

FLOURENS (flo͞o-räN'), **Léopold Emile,** public man, born in Paris, France, in 1841. He secured a general education and turned his attention to politics. In 1863-68 he was auditor of the imperial council, and in 1879 became superintendent of a department in the ministry of education, in which capacity he sided with

the policy of Justin Combes. He was made president of the department of legislation, justice, and foreign affairs in 1885, and the following year became minister of foreign affairs, which position he held until 1888. He is the author of a number of works relating to jurisprudence and contributed to current literature.

FLOWER (flou'ẽr), the bloom or blossom of a plant, the terminal bud inclosing the organs of reproduction. The *stamens* and *pistils* are the essential parts of a flower. These are usually surrounded by floral envelopes, the *calyx* and *corolla,* but in the lily, crocus, and other endogenous plants they are not distinguishable. The leaves of the calyx are called *sepals,* and those of the corolla are known as *petals.* In flowers the stamens, or male organs of reproduction, are composed of the *filament, anther,* and *pollen.* The pistils, or female organs, consist of the *style, stigma, ovary,* and *ovules.* Where both stamens and pistils appear in the same flower, it is said to be hermaphrodite or perfect, but, if only the stamens appear, it is unisexual or imperfect. A flower which has only the pistils is said to be barren or sterile. Sometimes both calyx and corolla are wanting, when it is said to be naked. If both the stamens and pistils are wanting, the flower is termed neuter or empty. An assemblage of flowers on a plant is called an *inflorescence.* If there is no flower stalk, or peduncle, of which the torus is the upper part, the flower is said to be sessile.



PARTS OF A FLOWER.

The primary object of the flower is to furnish the necessary elements of reproduction. To accomplish this essential function, the pollen must be transported from the stamen to the pistil, which may be done through the agency of insects, but in most cases is effected by the pollen falling or being blown through the air. The best results come from fertilization by pollen from a different flower of the same plant or from a different plant. Much has been done in floriculture to develop both a high degree of fertilization and showy blossoms.

FLOWER, Roswell Pettibone, statesman, born in Theresa, N. Y., Aug. 7, 1835; died May 12, 1899. His father died when Roswell was eight years old, which necessitated working as a farm hand and as clerk to aid in the support of his father's family. Later he took a course in the Theresa high school, became a school teacher, and later engaged in the trade of a jeweler. Subsequently, in 1869, he became a banker in New York City. In 1881 he was elected as a Democrat to Congress, was reëlected in 1888 and 1890, and in 1891 became Governor of New York. His administration as Governor was eminently successful, among the events of note being his prompt and able disposition of matters relating to the cholera scare. In 1895 he retired from politics to manage his vast business interests, and expended large sums of money for charitable purposes. Among his donations are those devoted to building the Flower Hospital in New York and several large churches. In 1896 he opposed bimetallism and aided in the defeat of his party in New York.

FLOWERS, Adoption of, the selection of flowers as symbols by certain states and nations. Floral symbols came into use in very early times and mention is made of them in the early history of China and in biblical literature. The lotus, or sacred lily, was consecrated to the gods in Egypt, and afterward became the national emblem. Many nations of antiquity used a code of floral symbols in decorating the surfaces of monuments and in making inscriptions in temples, but these are not understood. Throughout history is a line of records that conveys information in regard to the extensive use of flowers in national ceremonies, but the selection of particular flowers came about rather as a matter of sentiment than by legal or national adoption. Edward I. of England wore the red rose, from which circumstance the rose became the national emblem of that country. However, the British coat of arms contains the English rose, the Irish shamrock and the Scotch thistle. In Canada the maple leaf has been the national emblem since 1834. It is the leaf of the sugar maple of the forest, which is renowned for the brilliant colors of its foliage in autumn. The following is a partial list of the national emblems:

Canada	Maple Leaf
England	Rose
Egypt	Lotus
France	Fleur-de-lis, or Iris
Germany	Cornflower
Greece	Blue Violet
India	Lotus
Ireland	Shamrock
Italy	White Lily
Japan	Chrysanthemum
Mexico	Prickly Pear
Persia	Rose
Scotland	Thistle
Spain	Scarlet Pomegranate
Switzerland	Rare Edelweiss
United States	Goldenrod

Many of the states of the United States adopted flowers by a vote of the public school children, and in others adoptions were made by acts of the legislatures, as follows:

Alabama	Goldenrod
Alaska	Forget-me-not
Arizona	Sequoia Cactus
Arkansas	Apple Blossom
California	Poppy
Colorado	Columbine

(Opp. 1020) BEAUTIFUL FLOWERS.

Pansy.
Carnation.

Tulip.
Poppy.

Connecticut	Mountain Laurel
Delaware	Peach Blossom
Florida	Orange Blossom
Georgia	Cherokee Rose
Idaho	Syringa
Illinois	Violet
Indiana	Carnation
Iowa	Wild Rose
Kansas	Sunflower
Kentucky	Goldenrod
Louisiana	Magnolia
Maine	Pine Cone and Tassel
Maryland	Black-Eyed Susan
Michigan	Apple Blossom
Minnesota	Moccasin
Mississippi	Magnolia
Missouri	Goldenrod
Montana	Bitterroot
Nebraska	Goldenrod
Nevada	Sage-brush
New Jersey	Sugar Maple (Tree)
New Mexico	Cactus
New York	Rose
North Dakota	Golden Rod
Ohio	Scarlet Carnation
Oklahoma	Mistletoe
Oregon	Grape
Rhode Island	Violet
South Dakota	Anemone
Texas	Bluebonnet
Utah	Sego Lily
Vermont	Red Clover
Washington	Rhododendron
West Virginia	Rhododendron
Wisconsin	Violet
Wyoming	Gentian

FLOWERS, Artificial; the materials used in making artificial flowers include wax, shell, horn, whalebone, paper, rubber, ribbons, velvet, cambric, jaconet, calico, muslin, blown glass, crape, gauze, satin, bamboo, and feathers.

FLOWERS, Language of, the method of using flowers as types to express thoughts and feelings. The art of using flowers to convey messages originated in ancient times, when the custom was better understood and more generally practiced than at present. An extensive flower language was developed in the western part of Asia at a remote period, but the Greeks and Romans conveyed to us the most authentic record of its use and application. Though nations widely remote from each other cultivated the use of such a language, it is interesting to note that they agreed in applying the same sentiment to many of the flowers. For instance, the amaranth signifies immortality; the oak leaf, power; the moss rosebud, a confession of love; and the white rose, happy love. The following is a partial list of the more important flowers used in expressing sentiments:

Amaranth	Immortality
Anemone	Anticipation
Apple Blossom	Preference
Aspen Leaf	Fear
Brier	Insult
Buttercup	Riches
Camellia	Illness
Calla	Pride
Candytuft	Indifference
Cornflower	Heaven
Cowslip	Youthful Beauty
Cypress	Death
Daffodil	Unrequited Love
Daisy	Simplicity
Dandelion	Coquetry
Evergreen	Hope
Everlastings	Undying Affection
Fern	Forsaken
Five-leafed Clover	Bad Luck
Forget-Me-Not	True Love
Four-leafed Clover	Good Luck
Foxglove	Insincerity
Geranium	Deceit
Goldenrod	Encouragement
Heather	Loneliness
Heliotrope	Devotion
Hepatica	Anger
Honeysuckle	Fidelity
Hyacinth	Sorrow
Ivy	Trustfulness
Laurel	Fame
Lilac	Fastidiousness
Lily	Majesty, Purity
Lotus	Forgetfulness
Marigold	Contempt
Moss or a dry twig	Old Age
Myrtle	Wedded Bliss
Narcissus	Vanity
Oak Leaf	Power
Orange Blossom	Marriage
Oxalis	Pangs of Regret
Palm Leaf	Conquest
Pansy	Loving Thoughts
Poppy	A Tryst at Evening
Rosemary	Remembrance
Rue	Repentance
Scarlet Geranium	A Kiss
Snowdrop	A Friend in Need
Sting Nettle	Rudeness
Sweet William	Gallantry
Tuberose	Bereavement
Tulip	Boldness
Violet	Modesty
Yellow Rose	Jealousy

FLOYD, John Buchanan, statesman and soldier, born in Blackburg, Va., June 1, 1807; died Aug. 26, 1863. He attended the College of South Carolina, was admitted to the bar, and practiced his profession in Arkansas and Virginia. In 1847 he was elected to the Virginia Legislature, and became the Governor of that State in 1850. From 1857 to 1860 he was Secretary of War, but resigned in the latter year to join the Confederate States. The following year he became brigadier general in the Confederate army and commanded at Fort Donelson, where he was defeated, and soon after was relieved of his command.

FLÜGEL (flü'gĕl), **Otto,** philosopher, born at Lützen, Germany, in 1842. He studied at the University of Halle, near which city he served as pastor of an Evangelical church, and in 1894 founded the *Journal of Philosophy and Pedagogy.* As an editor and writer he was prolific and searching, and contributed much to educa-

tion and the upbuilding of intelligence. He supported the realistic philosophical theories of Herbart as opposed to the tenets of Kant. Among his writings are "Speculative Theories of the Present," "Materialism from the Standpoint of Nature Study," "Treatise Regarding the Soul-Life of Animals," and "Social Teachings of Jesus."

FLUIDS (flū'ĭds), the substances whose molecules change places freely by slight pressure. They include liquids and gases, as opposed to solids. Liquids possess no definite shape, but assume that of the vessel in which they are kept, except at the upper surface, which is level. Gas inclosed in a bottle presses upward against the cork as well as against the sides and base. From this fact liquids are said to be nonelastic fluids and gases are termed elastic fluids.

FLUKEWORM (flūk'wôrm), or **Fluke**, the name of several kinds of worms found in the liver and biliary ducts of sheep, in which it causes the disease commonly called *rot*. The eggs, which are laid in the liver, pass to the exterior by means of the gall and the intestines and hatch on the wet grass. After undergoing a complicated process of development, they crawl about on the grass and are eaten by the sheep, and inside of the stomach undergo another form of metamorphosis. Later they bore through the animal tissue and find lodgment in the liver, where they reach sexual maturity. Other species attack birds and fishes, and a kind common to Egypt infests different organs and tissues of man.

FLUORESCENCE (flū-ŏ-rĕs'sens), the property possessed by some transparent bodies which causes them to produce at their surface, or within their substance, light of a different color than that of the mass of the material. This may be demonstrated by exposing green crystals of fluor spar to light, when the reflections are blue. This is due to the property which the substance has of modifying the light striking upon it. Glass colored of a yellow tint with oxide of uranium, known as canary glass, produces fluorescence of a brilliant green tint.

FLUORINE (flū'ŏr-ĭn), a nonmetallic element separated from fluor spar or fluoride of calcium by the action of sulphuric acid. It is not found native and can be isolated only with great difficulty, since it combines very readily with different substances. The stems of grasses, mineral springs, sea water, and many animal substances contain fluorine. Compounds of fluorine are used in preserving food, in etching glass, and for antiseptic purposes. It has the property of corroding objects with which it comes in contact, hence must be preserved in lead or ceresin bottles.

FLUOROSCOPE (flû-ŏr'ŏ-skōp), an instrument employed to transfer X-rays into light. This light enables an observer to see through several inches of wood, observe the bones of the living body, or other objects of dense construction in bodies usually opaque. The fluoroscope was invented by Thomas A. Edison, who tried over 800 different salts in experimenting to perfect a suitable instrument. The most satisfactory fluoroscope consists of a rectangular box a foot long, tapering toward the farther end, at which a fluorescent screen is placed. The inside of the box is painted black. The screen is made of pasteboard, covered with white paper and then coated with collodion, on which fine crystals of calcium tungstate are sifted. In passing four amperes through a Crookes tube, and holding an object between it and the fluoroscope, the observer can see through the screen and the object, and thus study visually the phenomena discovered by Röentgen.

FLUOR SPAR (flū'ŏr spär), the fluoride of calcium, which occurs especially in deposits of cobalt, tin, silver, lead, and other beds of metals. It is usually blue, green, yellow, or pink, though it occurs also in colorless and transparent forms. Fluor spar occurs in Norway, England, and Germany. The annual American product is valued at about $115,000, and is obtained chiefly in Kentucky and Illinois. It is used as a flux in iron smelting, and in the manufacture of opalescent glass and hydrofluoric acid.

FLUTE (flūt), one of the oldest wind musical instruments. It has four joints, tapers toward one end, and contains a number of holes to be covered with the fingers or by keys. Some flutes have a mouthpiece, but others are played by placing the lower lip close against the hole of the outside and blowing the air so its passage is broken against the opposite edge of the hole, causing the air inside the hole to vibrate. Its soft, pleasant tone and wide range in compass make it an important instrument in orchestral music.

FLUX (flŭx), a substance used to promote the fusion of minerals, or to cause their decomposition. Many materials are employed for this purpose, depending upon the nature of the body to be treated and the chemical action desired. Limestone unites with the alumina and silica of iron ores, hence is the usual flux employed in the blast furnace. Borax forms fusible compounds with silica and other bases and is used very generally as a flux. Cyanide of potassium is employed both as a flux and a reducing agent and niter and litharge are good fluxes and oxidizing agents. Many substances, such as litharge, boracic acid, and red lead, are used as flux in making pottery.

FLY, an insect characterized by possessing but two wings, the posterior set being reduced to a pair of so-called balancing rods, or legs. The proboscis or underlip ends in two flaps, which are used for lapping. A long list of pests belongs to the order Diptera, or two-winged insects, such as gadflies, bat flies, blow-

flies, and the common house flies. About 40,000 species have been described, but these are thought to be only about one-eighth of the number which at present are represented by living species. To these may be added a long list of extinct and fossil flies. Not less than

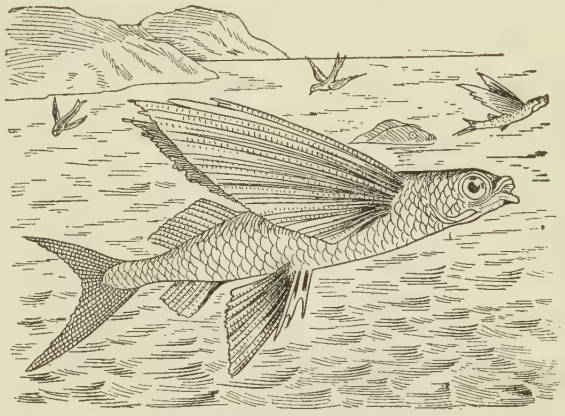
1, MUSCID; 2, SYRPHUS; 1*a*, FLY'S FOOT.

1,500 species have been described from the fossils found in the shale beds of Florissant, Colo., and many other sources are fully as prolific.

The eggs of a fly hatch into larvae in about a day. They then pass into a quiescent pupa stage for several days more, whence they issue as full-grown insects. In warm climates flies are seen the entire year, but where the winters are cold they disappear on the approach of heavy frosts. A few survive the winter in sheltered places. These, together with some of the eggs and pupae, preserve the species. Flies are enabled to walk on smooth surfaces and ceilings with their backs downward by a hairlike cushion which serves to hold them in place, partly by a glutinous fluid secretion and partly because of their ability to remove the air from below the feet by means of suckers through the hair, the pressure of the air on the outside serving to support the insect. The muscid, or house fly, and the syrphus, or drone fly, are well-known species of these insects.

FLYCATCHER (flī'kăch-ẽr), the common name of many birds native to America, so named from their ability to catch flies and other insects. They have the habit of waiting until the insect comes very near, when they dart suddenly to secure it, after which they return to the same place. Birds of this class are seldom seen on the ground or in the act of chasing insects in the air like swallows. The *Savannah flycatcher* is common to the southern part of the United States. About 350 species are native to North America, and they are widely distributed from Panama to the northern part of Canada, but are best represented where insects are most numerous. Only four species are native to Europe, including the *spotted flycatcher* seen both in Great Britain and on the continent. The kingbird (q. v.) belongs to the family of flycatchers.

FLYING FISH, a name applied to all fishes which have large pectoral fins and are able to sustain themselves in short seeming flights above the water. A large number of species belong to this class, about thirty, and two families, most of which are common to the warm zones. They swim in shoals near the surface and, leaving the water, often dart through the air for a distance of several hundred feet. Little, if any, force is acquired while the fish are in the air, but, instead, the strong tail seems to be the only source of motive power, the winglike pectoral fins serving rather as parachutes to support the body in the air. It does not seem true that these fishes leave the water merely to escape danger as has been asserted by some writers, but they do so as a means of exercising in the air, of which they appear to be fond. The *flying gurnard,* a spiny fish of the Gulf of Mexico and the Atlantic coast, emits a phosphorescent light in the night. Flying fish rarely rise more than four feet above the water, but when a school is met by a small boat they move in all directions and sometimes a few fall upon the



FLYING FISH.

deck. They are about a foot long and are held in high esteem as food.

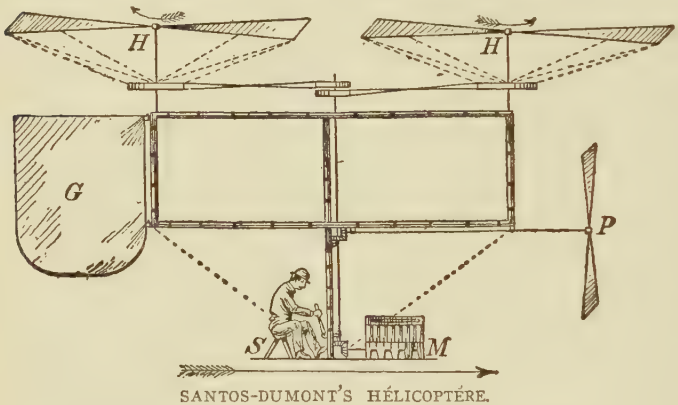
FLYING MACHINE, a mechanical structure designed to navigate the air. It differs from a balloon mainly in that a flying machine is heavier than the air, while a balloon is lighter. Efforts to navigate the air by means of mechanical apparatus have been made for about five centuries and, though some degree of success was made in the last century, the successful solution of the problem has been approached only within the last decade. *Aëronauts* constitute a class who think air navigation possible only by means of balloons, while *aviators* have been multiplying in numbers, believing it possible to perfect flying machines with which movement in the air will be as safe and rapid as upon the land or the water. They have studied the structure and flight of large birds and from them have drawn lessons so valuable that the perfection of a safety flying machine is fast nearing its culmination.

In the 17th century Bernier, of Sable, France,

constructed two pairs of wings, which he fastened to the shoulders and ankles with leather straps. By means of these mechanical devices he was able to guide himself in the air and fly for some distance, especially when starting by running from an elevation and thence moving over the valley beneath. In 1896 the secretary of the Smithsonian Institute, Prof. S. P. Langley, completed his *aërodrome,* a flying machine which he sent up with much success, and perfected it to such a state that it was possible to move, ascend, and return successfully. O. Chanute, of Chicago, in the same year carried on elaborate experiments with his *aëroplane,* which enabled him to fly and soar quite successfully.

The German aviator, Otto Lilienthal, up to 1901 attained the greatest success in flying. In construction his machine was very closely modeled after the characteristics of birds. The apparatus had outspreading wings, which were made in imitation of the spreading pinions of a bird, and was constructed of light wooden frames covered with cotton drilling. In flying, the legs of the operator were free, thus enabling him to start by running or from elevations much like the larger birds. The construction was such that he was suspended safely within the lower part, leaving the body and limbs quite free to move, and in this way he was permitted, at least to some extent, to direct the course to be taken. On a number of occasions he soared to heights far above the starting point and moved over considerable distances. Dr. Danilewsky, of Charkov, Russia, completed and used a flying machine in 1898, which combined with aviation the principle of a balloon, and gave rise to the newer *dirigible* balloons. In the meantime the United States appropriated $25,000 for experiments relating to aërial navigation. The investigations were instrumental in obtaining a number of improvements, such as combining steam, electric, gas, and compressed-air motors with the machines to secure motive power. At the same time many screw and fan devices to guide and propel were invented. On July 2, 1900, Count Zeppelin, a German cavalry officer, made a successful flights with his dirigible balloon, which combines the principles of a balloon and a flying machine, sailing eighty miles per hour.

Henry Farman, the French aëronaut, won the Deutsch-Archdean prize of $10,000 with his flying machine in 1908. It, like the *hélicoptère* or screw flyer of Santos-Dumont, is heavier than air. Another machine of this pattern is the airship of M. Le Baudy, which has a record of sixty miles in two hours and 46 minutes. At the head of the list of successful inventors stand Orville and Wilbur Wright, two American aëronauts, whose aëroplane, the *Bird of Prey,* demonstrated much capacity for flying long distances. Many notable discoveries in aviation were made from practical experience in the Great European War. It is now possible to fly across continents and oceans, to carry passengers and many tons of freight, and to reach altitudes exceeding 40,000 feet.



SANTOS-DUMONT'S HÉLICOPTÉRE.

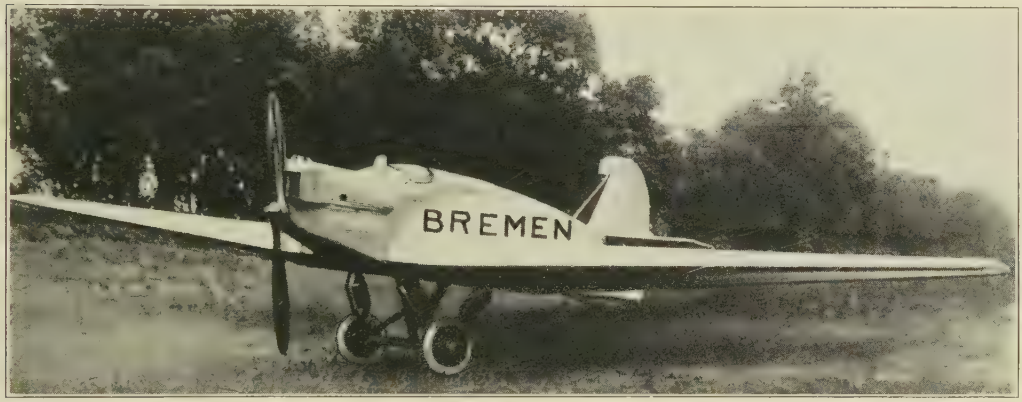
H, H, Lifting propellers; *P,* Driving propeller; *G,* Rudder; *M,* Motor; *S,* Aëronaut's seat.

FLYING SQUIRREL, a species of the squirrel family, about five inches long, having a fold of skin extending along each side between the fore and hind legs. The tail is about four inches long and has two horizontal rows of hair, which aid to direct its motion and support the body in the air. It does not fly, but sails through the air as a parachute.

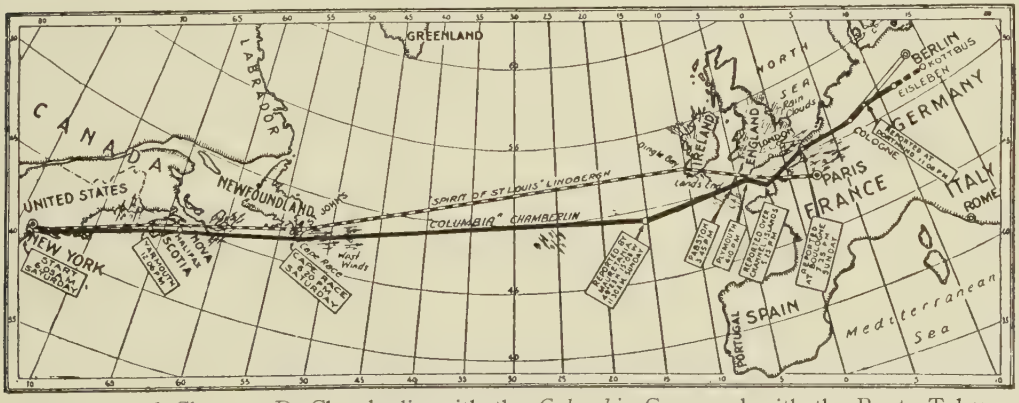
FOCH, Ferdinand, military leader, born in France in 1851. He studied military service and became a professor of the French war school, where he officiated many years. In 1914 he had command of the army at Châlons, and directed the operation on the Somme and the Iser. President Poincaré invested him with the insignia of marshal and he was made commander-in-chief of all the forces of the Entente Allies. Marshal Foch is noted as a great strategist and commander, and much authority was given to him after the close of the war in carrying out the conditions imposed under the armistice and in the work of reconstruction. He made several visits to Canada and the United States.

FOG, a thick mist at or near the earth's surface, resulting whenever the temperature of the air is reduced slightly below the dew point. The minute drops of water that form fog, though 800 times heavier than air, are prevented from settling rapidly by the resistance of the atmosphere. This is rendered possible by the minute size of the drops, which are much smaller than the relatively heavier dust particles common in the air and wafted

Col. Charles A Lindbergh's Airship, *Spirit of St. Louis,* Ready to Make the Flight to Mexico City.



The *Bremen,* the First Monoplane to Cross the Atlantic Westward, in 1928, Manned by two Germans, Capt. Hermann Koehl and Baron von Huenefeld, and an Irishman, Com. James E. Fitzmaurice.



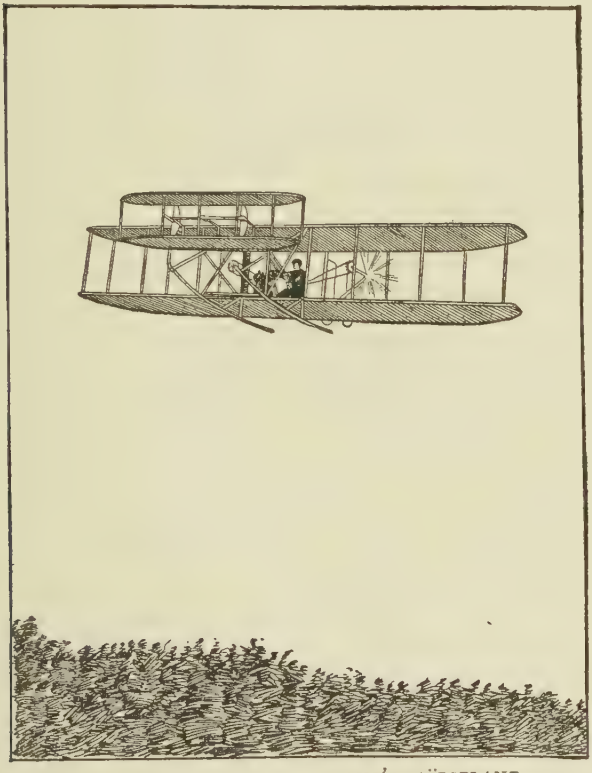
Route of Clarence D. Chamberlin with the *Columbia* Compared with the Route Taken by Col. Lindbergh. (See pages 528 and 1597.)

NOTABLE ACHIEVEMENTS IN AVIATION IN 1927 AND 1928

(Opp. 1024)

about by the wind. Fogs disappear on the approach of warm winds. Off the banks of Newfoundland the warm, moist air of the Gulf Stream is cooled by the cold air of the Labrador ocean current, hence frequent and almost constant fogs arise.

FOGAZZARO (fō-gä-tsä′rō), **Antonio,** novelist, born in Vicenza, Italy, in 1842; died Mar. 6, 1911. He attended the schools of his native city and had the advantage of a thorough training for a literary career. In 1874 he published his first poem that attracted attention, under the title of "Miranda," and two years later published "Valsolda," a collection of lyrics. Subsequently he turned his attention to novel writ-



ORVILLE AND WILBUR WRIGHT'S AËROPLANE.

ing, into which he was able to weave realistic imagination and invention, attaining thereby a high reputation among the writers of Italy. Under the title of "Fedele" he published his best story, which has been widely translated. Other writings include "Malombra," "Daniele Cortis," "Eva," and "Alla Vigilia."

FOG SIGNALS, the signs communicated in foggy weather by sounding a whistle, ringing a bell, firing guns, or by other methods in order to avoid collisions and prevent vessels from running upon places of danger. Light and other signals cannot be seen, so notice can be given only by sound. The steam siren foghorn invented by Cagnard de la Tour, now employed by the United States lighthouse board, is the most effective signal used, and can be heard a distance of twenty to thirty miles. A class of fog signals are used on railways to indicate a safe distance at which trains may approach each other, or to indicate points of danger on the track, such as broken rails, landslides, and defective bridges. They are in the form of small torpedoes in which a detonating powder, when they are struck by the wheels of the engine, makes a loud report.

FOLEY (fō′lĭ), **John Henry,** sculptor, born in Dublin, Ireland, May 24, 1818; died Aug. 27, 1874. He studied at the Dublin Society of Art and at the Royal Academy in London. In 1839 he exhibited "The Death of Abel," and the following year gained a reputation by his "Ino and Bacchus." The latter gave him immediate recognition and in 1844 he was chosen one of the artists to do work in sculpture for the decoration of the houses of Parliament. Among his larger works is the colossal statue of Prince Albert, now in the Albert Memorial in Hyde Park. Foley designed the seal of the Confederate States of America, and executed a bronze statue of Stonewall Jackson for the State of South Carolina. In 1858 he was made a member of the Royal Academy. Among his later productions are "Youth at a Stream," "Death of King Lear," "Prospero and Miranda," and "Lear and Cordelia."

FOLGER (fōl′gĕr), **Charles James,** jurist and statesman, born in Nantucket, Mass., April 16, 1818; died in Geneva, N. Y., Sept. 4, 1884. After studying law, he was admitted to the bar of New York in 1839, and the following year settled in Geneva to practice his profession. In 1856 he joined the Republican party, was a State Senator from 1861 to 1869, and in the latter year became Assistant Treasurer of the United States in New York, under appointment by President Grant. In 1871 he was elected to the State court of appeals. He was chief justice of New York in 1880, and in 1881 became Secretary of the Treasury under President Arthur. As a candidate for Governor of New York, in 1882, he was defeated by Grover Cleveland with a majority of nearly 200,000.

FOLK, Joseph Wingate, public man, born at Brownsville, Tenn., Oct. 28, 1869; died May 28, 1923. He graduated from Vanderbilt University. In 1890 he was admitted to the bar and established a large law practice at Saint Louis, where he was successful as district attorney in prosecuting a number of bribery cases. He was nominated on the Democratic ticket in 1904 as a reform candidate for Governor of Missouri and was elected with a vote much

larger than that of his party. His administration of the office was eminently successful and satisfactory to his constituents.

JOSEPH W. FOLK.

FOLKLORE (fōk'lōr), a term used to signify the scientific study of popular customs, tales, superstitions, and primitive belief and usages. The term was compounded from several German words employed to designate this study, such as *Volkslied* and *Volksfest*. Though many trivial matters are taken into cognizance, the study has marked value in that it throws light on the origin and development of political and religious beliefs and ceremonies, as well as different ideas regarding the relationship between races. It is this feature of folklore that has made it of special value to historians, sociologists, and writers on ethnology. Besides, through its study more comprehensive views have been formed. The science owes its origin to the Grimm Brothers, who began collecting stories as told by peasants, and after a research of more than twelve years published their collection. Soon after intense interest was aroused in the establishment of folklore societies, the founding of journals, and the publication of various books relative to these researches.

The American Folklore Society was founded in 1888 at Cambridge, Mass., and has directed its energies largely to the publication of books and periodicals relative to the folklore of North America. Its official publication is the *Journal of American Folklore*. Such institutions as Johns Hopkins University have given their energies to the furtherance of interest in the science. North American folklore has been extended largely within recent years, and now represents an interesting fund of knowledge relative to the Indians, Aztecs, and Eskimos. Institutions having a like object are maintained in the countries of South America and Eurasia. By means of extensive research it has been possible to add a very useful and extensive fund of knowledge to the history of primitive races.

FOND DU LAC (fŏn dû lăk'), a city in Wisconsin, county seat of Fon du Lac County, on Lake Winnebago, about sixty miles northwest of Milwaukee. It is on the Soo Line, the Chicago and Northwestern, and the Chicago, Milwaukee and Saint Paul railroads. Being on Lake Winnebago, it has communication with the Great Lakes by the Fox River. It is surrounded by a fine farming and dairy region. Among its principal buildings are the Y. M. C. A., the county courthouse, the high school, the public library, and Grafton Hall, an Episcopal school for girls. The manufactures include flour, ironware, woolen goods, furniture, machinery, and utensils. The municipal facilities include street railways, gas and electric lighting, pavements, waterworks, and several parks. It was settled in 1836 and incorporated in 1852. Population, 1920, 23,427.

FONSECA (fôn-sā'kä), **Manuelo Deodoro da,** first president of Brazil, born in 1827, died Aug. 23, 1892. After graduating at Rio Janeiro, he entered the army. In the War of 1865 between Brazil and Paraguay he distinguished himself and rose to the rank of major. Later he became imbued with republican ideas, succeeded to the governorship of Matto Grasso, and in 1889 led a revolution against Emperor Dom Pedro, in which the latter was expelled from the country. General Fonseca was made the first president of the republic, but, owing to his oppressive and self-seeking designs, his administration was brought to a close by a revolution and Vice President Peixto was elected to succeed him.

FONSECA BENEVIDES (bā-nā-vē'dăz), **Francisco da,** author and scientist, born in Lisbon, Portugal, in 1835. He was a son of a physician and studied medicine under the direction of his father, and in 1851 joined the navy. In 1854 he was made professor of physics in the industrial school at Lisbon, became a teacher in the naval academy in 1855, and the following year was chosen a member of the Lisbon Academy. The government appointed him as representative to a number of national expositions, in which capacity he attended Paris in 1878 to exhibit a line of scientific apparatus. His writings are devoted largely to history and scientific subjects. They include "Curso de physica," "O Fogo," "As rainhas de Portugal," and "Elementos de balistica."

FONTAINEBLEAU (fôn-tān-blō'), a town in the department of Seine-et-Marne, France, near the Seine River, about 37 miles southeast of Paris. It is a clean, quiet place with broad streets, and owes its fame chiefly to the palace of the kings. This is one of the most beautiful palaces in France. It was founded by Robert the Good in the 10th century and has been greatly improved by many succeeding kings. The chateau, or park, in which it is situated is a magnificent expanse of forest, in which are fountains, statues, flowers, and artificial lakes. Napoleon detained Pope Pius VII. as prisoner at Fontainebleau for two years. He signed his abdication here in 1814 and again in 1815. The town manufactures porcelain and wines and, owing to its extensive pleasure grounds, ranks as a favorite resort for visitors. Population, 1922, 14,381.

FONTENOY (fônt-nwä'), a village in the

province of Hainaut, Belgium, five miles southeast of Tourney. It is celebrated on account of a battle, on May 11, 1745, between the allied forces of Austrians, Dutch, and British and the army of France, each side numbering about 60,000 men. The French were commanded by Marshal Saxe and the allies by the Duke of Cumberland. The result was a forced retreat of the allies with a loss of 7,000 on each side.

FONVIELLE (fôn-vyĕl'), **Wilfrid de,** aëronaut and author, born in Paris, France, July 26, 1828; died in 1914. He became a teacher at an early age, but shortly after engaged in journalism and edited *Algérie Nouvelle,* which was suppressed by the government because of its revolutionary tendency. In 1858 he made a number of ascents in a balloon and became distinguished as an aëronaut, and in 1870 escaped from Paris in a balloon while that city was besieged. Subsequently he made ascents for the purpose of studying meteorology. As a journalist and lecturer he favored the republican form of government. His publications include "Fossil Man," "Thunder and Lightning," "Wonders of the Invisible World," and "How Republics Perish."

FOOCHOW (fōō-chou'), or **Fu-Chow,** capital of the province of Fo-Kien, China, situated on the Min River, about 25 miles from its mouth. Massive walls surround the city, while its streets and buildings show more than the ordinary Asiatic progress. In 1843 it was thrown open to foreign trade, since which time it has developed large manufacturing and commercial enterprises. It has extensive dockyards and an arsenal, which are under the direction of European influences. The city is the seat of several scientific societies and numerous missionary organizations. Population, 1922, 638,250.

FOOD, any substance that, being taken into the body of animals or plants, serves, through organic action, to build up normal structure or replace the waste of tissue. Plants feed on the carbonic acid gas of the atmosphere and a series of chemical compounds found in the soil. The living plants change the soluble air foods into plant tissues, cells, and granules under the influence of sunlight. Certain materials fitted to become the food of man or animals are stored in various parts of the structures, notably the roots, stem, and seeds, of which such as fats, sugar, starch, and proteids constitute the most noteworthy. Animals of the higher scale do not possess the power of changing the compounds of the soil and air into animal tissues. For this reason they feed directly upon the products of plant growth, or indirectly by eating flesh of other animals, and build up the complex animal muscle, fats, starches, and proteids, which are suitable for the food of man.

Liebig classified foods into those that serve for nutrition of organized tissue, or flesh-formers, known as *nitrogenized elements* of nutrition, and those which are consumed in respiration, or heat-givers, called *nonnitrogenized elements.* These elements exist in some form of combination in almost every substance known as food, and are subservient to the function of organic action in the process of digestion. The list of diets of most peoples includes fats and oils, the vegetable oils in the warm regions and the fats in the cold and temperate. Milk contains all the necessary food elements in the best form. Nitrogenous food-stuffs are found principally in the flesh of birds, animals, and fish; in milk, cheese, and eggs; in barley, wheat, oats, corn, and flour; and in beans, peas, and vetches. They are formed exclusively in plants, and undergo but little alteration when consumed as food and stored up by animals.

Fats are derived principally from milk, the bodies of birds and animals, and the blubber of sea animals. The oils are obtained mostly from the olive, the palm, the cocoanut, the rape, cotton seed, and fish. Corn and some other grains contain more or less oil substances and these, like most vegetable oils and fats, resemble those of animals. Starchy foods are of much importance in a normal diet. The starchy substances are derived mostly from the vegetable kingdom, and constitute the principal portion of the food of people who live in the tropical and temperate regions. The starches of the tubers, roots, grains, fruits, and milk embrace this class. These and other vegetable products contain hydrogen, oxygen, and carbon, but they differ in physiological properties from the oils. Water and salts are as essential for healthy nutrition as the proteid class, the former constituting 68 per cent. of the human body. It is one of the important constituent parts of many articles of food. Besides, there are accessory foods, such as vinegar, coffee, tea, relishes, and spices, which are used more or less habitually, though the exact nutritive value of many of them is not known definitely.

The body needs a variety of food to support the different tissues. In the economy of growth it is required that both the carbonaceous and nitrogenous elements be taken in sufficient quantities. The very instinct of man suggests the blending. Bread is eaten with butter; macaroni is prepared with cheese; rice is boiled with milk; pork is baked with beans, and other food articles are mixed similarly. Food is oxidized in each cell of the body, though only a small portion of the albumen eaten is required in their reconstruction; the remainder, and the fats and sugars, are oxidized without becoming a part of the living cells of the body.

The average man, in order to repair the waste caused by the oxidation of the cells, and to supply the requisite amount of heat and energy, must assimilate daily about four ounces of albumen, four of fat, and five of sugar or starch. To oxidize this it is necessary to breathe 24 ounces of oxygen. The weight of the body is increased by albumen being changed to fat, which occurs when more food is eaten than this

amount of oxygen can oxidize. An increase in the breathing capacity enables the body to oxidize more food and lessens the bad effects of overeating. Too much food causes plethora, while depriving the body of one kind of food for a considerable time causes it to suffer. When plain food is eaten slowly, hunger and taste are the most reliable guides as to quantity.

The subject of pure food has received much attention in the leading governments of Europe and America the past decade. This movement was brought about by widespread adulteration of medicine, beverages, and articles of food. The Federal food and drug act which went into effect on Jan. 1, 1907, is the most important legislation of this class enacted in the United States. This law made it unlawful to manufacture or sell within any territory of the Union, or to engage in the interstate or foreign commerce of any article of food or drug, which is adulterated or misbranded. This law requires that the weight marked upon a package shall be the actual weight, not an approximate weight. If drugs are imitations, they are held to be *misbranded.* Pure food laws have been enacted generally in the states of the Union and in the provinces of Canada.

FOOLS, Feast of, a festival celebrated for several centuries in a number of countries of Europe, especially in France and Spain. It was a season of Christian merrymaking and partook of a childish character. The festival was celebrated more or less during the entire period between Christmas and Epiphany (Jan. 6), but belonged especially to Innocent's Day (Dec. 28). It resembled the Roman Saturnalia, and the chief participants included the subdeacons and laity. In the exercises they chose a mock bishop, archbishop, or pope, who presided at the meeting in the church, and the rites of Christianity were gone over in the ceremonies. Dancing, the singing of commonplace songs, and the wearing of masks and disguises were practiced. The Protestant Reformation counteracted the extravagancies of these festivals and put an end to them in Germany and England, but they survived in France until 1644.

FOOT, a unit of linear measurement, containing 12 inches. A surface, each side of which is 12 inches, is a square foot, and is equal to 144 square inches. A cube whose sides are 12 inches is a cubic foot and contains 1,728 cubic inches. The foot unit was derived from the human foot. It is used extensively as a common measure, though its length varies in different countries. In music and poetry, a foot is a term used to denote a melodic figure of notes with only one accent, or a succession of accented or unaccented syllables, which, being repeated, produce rhythm. The four principal feet in England poetry are the anapest, the dactyl, the iambus, and the trochee.

FOOT, the extremity of the leg below the ankle, and on which the body is supported. In man the foot is composed of seven tarsal and five metatarsal bones, so arranged and connected as to form an arch from the extremity of the heel to the ball of the toe, and the phalanges. The bones, where they articulate with one another, are covered with a considerable layer of elastic cartilage. Between the bone at the heel and the ends of the metatarsal bones is a heavy ligament known as the *plantar ligament,* which not only holds the bones together in the form of an arch, but protects the blood vessels, nerves, and muscles that lie above it in the hollow of the foot. Another very strong, elastic ligament holds the heel bone and the central bone of the arch together. The head of the key bone, upon which the tibia sits, rests upon this ligament. The different motions of the foot are effected by five muscles. They include the *calf,* attached to the thigh and leg and below by the tendon of Achilles to the heel bone, which is the largest tendon in the body and sustains its weight in walking; the *posterior tibial,* attached at one end to the tibia and the other to the instep bone (scaphoid); the *short fibular,* attached to the fibula at one end and to the outer metatarsal bone at the other; the *anterior tibial,* which raises the toes and turns the foot outward; and the *third fibular,* whose tendons pass in front of the ankle on either side of the foot and raise the inner or outer border of the foot. The bottom of the foot is padded with fat and covered with a strong, tough skin. It forms the *sole* of the foot.

FOOT AND MOUTH DISEASE, an infectious disease common to domestic animals, especially swine and cattle. It occurs most frequently in Europe and Asia, but sometimes spreads to Africa and other continents. During a wide-spread attack of the contagion, it sometimes affects sheep, goats, and man, being conveyed to the last mentioned by the use of milk or meat from diseased animals. It is often fatal to young animals, but in adults it partakes of a lighter form, usually as a fever or constitutional weakness. The bacteria which causes the disease is not well understood, but it is known that the period of incubation is from three to six days, and that the virus may be destroyed by exposure to sunlight or antiseptics, such as formaldehyde and carbolic acid. Animals affected have symptoms like those of pneumonia and bronchitis and their feet, mouth, and other parts are subject to eruptions from which virus exudes. The treatment recommended is that affected animals be separated from others and quarantined, and the affected parts may be treated with antiseptic solutions.

FOOTBALL (fo͝ot'bal), a popular game played by pupils in the higher grades of the public schools and by students of colleges and universities, especially during the autumnal season of the year. It is an ancient game, having been popular during the prosperous eras of ancient Greece and Rome. The northern countries of

continental Europe adopted it about the time of the Roman invasions, while the Danes popularized it in England, where it became famous as a Shrove Tuesday sport as early as the 12th century. Though popular for centuries, it has taken a wider hold on the world of sport within recent years and is played with an ever-increasing fervor. Among the numerous and widely known associations are those called Rugby Association, Australian, and American Intercollegiate. Each of these and many others have definite rules, under which the members practice in the art of playing, and at specified times engage in competitive games with other associations. The associations organized at the three universities of Harvard, Princeton, and Yale have been known as the *Big Three,* while similar association ties have been accorded to the Canadian, Central Western, Rocky Mountain, and other groups of organizations.

The game is played by a team of 11 players on each side upon a level field. Scoring is possible in the field of the opposing side, either by getting the ball through or over a goal, or by passing it over a certain line. Each side, therefore, with the view of scoring, sends the ball in the direction of the opponents' end of the field. This may be done in two ways—by kicking and running, or by advancing it in any way except by running. The field is usually 160x300 feet, and the ball is made of leather, having a large ellipsoidal form. Among the officials are one headlineman, an umpire, and a referee. The losses and advances on either side are watched by the headlineman, the defensive side is watched by the umpire, and the referee watches the offensive side. In most associations the time of the game is 60 min., divided into four quarters of 15 min., with intermissions of one min. after the first and third and 15 min. after the second and fourth periods. The principal rules are known as the *Association Rules* and the *Rugby Rules.*

FOOTE (fo͝ot), **Andrew Hull,** naval officer, born in New Haven, Conn., Sept. 12, 1806; died in New York, June 26, 1863. In 1822 he entered the navy as midshipman, became lieutenant in 1830, and captain in 1849. When the Civil War commenced, he was given the command of the western flotilla. He was accorded a vote of thanks by Congress for valuable service rendered in the capture of forts Henry and Donelson and Island No. 10, and soon after was made rear admiral. In the capture of Fort Donelson he was wounded, and subsequently was placed in charge of the bureau of equipment and recruiting. In 1863 he was given command of the fleet off Charleston, but died before reaching the place where he was to operate.

FOOTE, Arthur, composer, born in Salem, Mass., March 5, 1853. He became interested in the study of music at an early age, and in 1874 graduated as a student of music at Harvard University, where he afterward took supplementary work. Later he studied piano and organ playing with B. J. Lang, and chose Boston as his home, devoting his time to organ and pianoforte recitals. He composed many works for the piano and the orchestra, among which is much church music. His compositions include "In the Mountains," "Skeleton in Armor," "The Wreck of the Hesperus," and "Farewell, Hiawatha." He composed about one hundred songs, including "On the Way to Kew," "Irish Folk Song," "O Swallow, Swallow," and "I'm Wearing Awa'."

FOOT ROT, a disease common among sheep. The most prevalent form is due to an unusual growth of hoof, which causes the margin or toe to turn downward and ultimately crack, thus causing openings in which dirt and sand readily lodge. As a consequence the feet become swollen and ultimately ulcerated between the toes, where proud flesh forms and causes decay.

FORAGE (fŏr′āj), a term used to designate any food suitable for horses, cattle, and sheep, including such as hay, straw, and ensilage. Among the forage plants cultivated extensively are clover, orchard grass, alfalfa, timothy, corn, broom corn, and sorghum. However, the straw and chaff of many cereals, such as wheat and oats, are important animal food products. The species of plants cultivated for forage depend upon the temperature and aridity quite as much as upon the different kinds of soil. In many portions of the West native grasses still constitute an important forage crop, while in the East and the arid regions of the far West forage plants are grown with a high degree of care. In the West and Southwest, where moisture is supplied by irrigation, the larger forage plants are cultivated extensively, such as alfalfa, sorghum, and millet.

FORAKER (fŏr′ā-kẽr), **Joseph Benson,** statesman, born in Rainsboro, Ohio, July 5, 1846. His boyhood was spent on a farm. In 1861 he entered the Union Army, serving until the end of the war. By faithful service he attained to the brevet rank of captain, and was aid to General Slocum's staff when mustered out. Shortly after the close of the war he entered Ohio Wesleyan University as a student and in 1869 graduated at Cornell. He was admitted to the bar of Ohio the same year. In 1879 he became judge of the superior court at Cincinnati, serving three years. He was elected Governor of Ohio as a Republican in 1885, which office he held until 1890. He was chosen as successor to Senator Brice in 1896 and was reëlected in 1902 for the term ending in 1909. In the Senate he was conspicuous as an opponent to the railway rate regulation favored by President Roosevelt, with whom he engaged in a controversy regarding the Brownsville, Tex., riot (Aug. 14, 1906) He died May 10, 1917.

FORAMINIFERA (fō-răm-ĭ-nĭf′ẽ-rà), a group of small animals, classed with the mol-

lusks on account of having beautiful shells. However, a few of the species are naked, while many have very complicated and remarkable coverings. They belong to the protozoan group and, like them, reproduce in all three ways common to that form of life. The species are widely distributed, but are most common in salt water. Fossils of these animals are very numerous, and vast beds of rock are constructed almost entirely of their shells. The chalk cliffs of England and the Silurian beds of Russia are examples of fossils of these animals.

FORBES (fôrbz), **Archibald,** special war correspondent, born in Morayshire, Scotland, in 1838; died March 31, 1900. After studying at Aberdeen University, he served for several years in the royal dragoons. In the Franco-German War of 1870-71 he was the special correspondent of the London *Daily News.* He afterward reported the events of the communistic rising in Paris, those connected with the tour made by the Prince of Wales in India, and later those of the Russo-Turkish War. In 1879 he followed the armies in the South African campaign, during which he rode 110 miles in fifteen hours to report the victory gained at Ulundi. Later his various writings were published in book form, as were also the events in connection with his lecture tours in Australia and America. Among his productions are "Drawn from Life," "Bivouacs and Battles," "Glimpses Through the Cannon Smoke," "Afghan Wars," "Students of War and Events," "Life of Napoleon III.," and "Life of William I. of Germany."

FORBES, Sir John, physician, born in Banffshire, Scotland, Oct. 18, 1787; died Nov. 13, 1861. He studied at Marischal College and became an assistant in the navy. In 1817 he was awarded a degree in Edinburgh. Subsequently he practiced medicine in Chichester and London, where he became the physician to the Prince Consort and later to the queen. In 1853 he was knighted. Besides being noted as a physician, he took high rank as a phrenologist and was a believer in mesmerism. He edited the "Cyclopaedia of Practical Medicine" and published "Nature and Art in the Cure of Disease."

FORCE (fôrs), an exertion or influence that, if made to act on a body, has a tendency to affect or stop it if in motion, or to move it when at rest. Light, heat, gravitation, electricity, motion, cohesion, magnetism, and chemical affinity are thought to be manifestations of the force from which originate all phenomena of the material world. Mechanical force originates from life, gravitation, and the sources of heat, light, and electricity. Two systems are used for measuring force, the Metric system and the English system, the dyne being the standard of measure in the former and the poundal in the latter. To measure the effect produced by any mechanical force it is necessary that three things be known—the point of application at which the force acts, the direction in which the force acts, and the intensity with which it acts. When two or more forces act in the same direction, the resultant is equal to the sum of the forces. If two equal forces act in opposite directions, thus opposing one another, the body acted upon remains at rest, but, if the forces acting are unequal, it moves in the direction of the greater with a force equivalent to their difference. Two forces acting at an angle with each other produce a resultant in an intermediate direction, the force of which equals the mean of the two acting forces. The *resolution* of a force is the separation of it into the components which produce that force, and the *composition* of forces is the combining of two or more into one.

Various terms are used to designate forces according to their nature and the manner in which they act. The most common classification includes parallel forces, constant forces, accelerating forces, resultant forces, uniform forces, and variable forces. By *parallelogram of forces* is meant the method of determining the direction and intensity of two forces, while *unit of force* implies a single force, whose terms being known, serves as a unit to ascertain the amount of any other force. The force exerted in a direction outward from the center, by a body moving in a circular path, is called the *centrifugal force,* while the *centripetal force* is exerted from without toward the center. Since the centrifugal force is a consequence of the rotation, it ceases when the centripetal force ceases, and the body moves in a straight line known as a *tangent.* The area in which a force acts is called the *field.* Centrifugal force is proportional to the mass and to the square of the velocity of the rotating body. If the mass of the rotating body be doubled, it requires twice the amount of force to prevent it from moving away from the center of motion, and, if the velocity be doubled, four times the force is necessary for it to retain its position. The motion of the planets around the sun affords good illustrations of centrifugal and centripetal forces. These bodies constantly tend to move away from the sun by reason of the motion originally given to them, while the attraction of the sun holds them in an almost circular path.

FORCE, Peter, historian, born at Passaic Falls, N. J., Nov. 26, 1790; died Jan. 13, 1868. He took up the trade of printer in New York City. In 1815 he removed to Washington, D. C., where he published the *National Calendar,* an annual treating of statistical information. In 1823 he began the publication of the *National Journal,* which was the official newspaper of the administration of John Quincy Adams. He was mayor of Washington in 1836-40. His most valuable work, entitled "American Archives," is a history of the American colonies and was

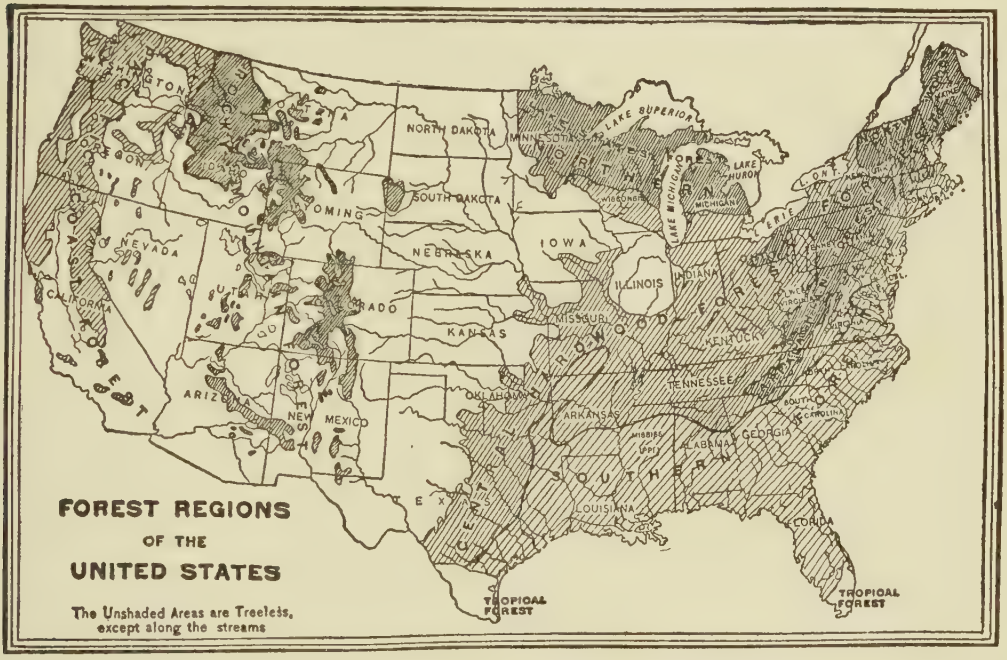
published by the direction of an act of Congress.

FORCE BILL, the name applied to several bills passed by the Congress of the United States. In 1828 a protective tariff act created much discontent and South Carolina claimed that the State had power to nullify objectionable Federal enactments. Congress passed a bill to enforce the tariff law in 1833, known as the Force Bill or the Bloody Bill. A bill for the enforcement of the Fourteenth and Fifteenth amendments to the Constitution became law May 31, 1870. It made punishable by fine or imprisonment all attempts at intimidation, bribery, or hindrance in the matters of registration and qualifying for voting. A stringent law was enacted in 1871 to put down the conspiracies against civil rights by the Ku-Klux Klan.

FORD, Henry, manufacturer, born at Greenfield, Mich., July 30, 1863. He learned the trade of a machinist in Detroit and organized the Ford Motor Company, which became the largest producer of automobiles in the world, employing 75,000 workmen and turning out 3,500 automobiles per day. In 1915 he organized a peace commission and proceeded to Europe with the avowed purpose of arbitrating to stop the war, but this venture, though laudable, did not prove successful. He founded the Henry Ford Hospital at Detroit at a cost of $2,000,000.

FORD, Paul Leicester, historian and novelist, born in Brooklyn, N. Y., in 1865; died in 1902. He was instructed in private schools in his native city and traveled extensively in America and Europe. His writings exhibit evidences of careful research and deep study, a fact due largely to the circumstance that he was a cripple and could not enjoy the usual institutional instruction. Among his historical works are "The True George Washington," "The Writings of Thomas Jefferson," and "The Many-Sided Franklin." His chief works in fiction are "Tattle Tales of Cupid," "The Honorable Peter Sterling," and "Janice Meredith."

FOREST (fŏr'ĕst), a large tract of land covered with a natural growth of trees and underbrush, though often with intervening spaces of open ground. The countries of Europe have provided protection by law, by which it is designed to preserve the forests for judicious use and prevent wholesale and needless destruction. Such acts of preservation operated to preserve many desirable tracts in Austria, Germany, France, and other countries, of which Epping Forest, near London, is a good



example. Similar laws have been passed in Canada and the United States, and, besides, there has been legislation aiming to extend rather than abridge the forest area. The timber-culture law passed in the United States in 1872 remained in force 21 years, and provided that 160 acres of the public domain could be acquired by cultivating ten acres of trees for a period of eight years. Under this act about 50,000,000 acres of trees were planted and cultivated in the great prairie regions of the West. The Nebraska State board of agriculture in 1874, under the suggestion of J. Sterling Morton, recommended that a day be dedicated each year to the planting of trees. This suggestion was acted upon by all the states and territories, not only through individual effort, but by the formal effort of public schools. As a conse-

quence many trees and tracts of timber have been planted and cultivated on private and public property. See **Arbor Day.**

Natural forests are found widely distributed where moisture is abundant and the temperature is favorable to plant growth. The forests of the Torrid Zone are the most luxuriant and cover vast areas along the streams and bodies of water, even to a considerable height above sea level. As we proceed north and south from the Equator we find the forests gradually decreasing in density and size of trees up to the higher latitudes, where they finally become rare and gradually disappear. The most extensive forests of the world are found in the valleys of the Amazon and Orinoco, the lake region of Africa, and in the southern parts of Eurasia. The higher altitudes, even in tropical countries, are destitute of forest growth, though plant life thrives in such regions at a much higher elevation than in the Temperate Zone and extends far into the higher latitudes, even to regions having much soil perpetually below the freezing point of water.

The forest area of the United States is placed by the Department of Agriculture at about 500,000,000 acres. Alaska has excellent timber and comparatively little of it has been put on the market. The output of lumber in the United States is 30,500,000,000 feet annually, of which the largest part is obtained in Wisconsin, Michigan, Minnesota, and on the Pacific coast. About one-fourth of the output is obtained in Michigan, Wisconsin, and Minnesota, which states yield an excellent quality of pine, hemlock, and the hard woods. Pine, fir, and spruce lumber is obtained in large quantities in Oregon, Washington, and California. The product is used chiefly in manufactures, railway construction, fencing, for building purposes, and for fuel. While there is danger of the visible supply decreasing beyond legitimate limits, the larger use of steel for construction purposes is relieving notably the demands annually made upon the forests. Besides, the consumption is affected by the increased use of coal, gas, and electricity for motive and heating purposes.

Forests are the natural home of many birds and wild beasts and have marked utility for their influence upon the occupations of man. They supply material for dyes, medicines, and numerous articles of value in the arts. The soil is enriched by the decaying trunks and foliage of trees. They furnish shelter from winds and storms in the winter and are a protection against the scorching heat of the summer. Their roots penetrate the soil and facilitate the entrance of water after rains and the shadow of their branches retards evaporation. In this way they extend the surface of moisture and visibly affect rainfall. This point of advantage is further accelerated by the fact that forests prevent accumulated snows from melting rapidly, thereby counteracting floods, such as result where the forest area is robbed of its timber. Where forests do not abound, the rainfall rapidly runs off the surface and finds its way back to the ocean. Besides causing floods, this tendency visibly influences temperature and productiveness.

The forest areas in the United States equal about one-third of the area of the country, exclusive of Alaska. About seven-tenths of the timbered area is between the Mississippi and the Atlantic coast. Of the entire forest wood 75 per cent. is coniferous, which requires about three-quarters of a century to grow to maturity. Timber of much value is obtained from the Philippines, where the forest areas exceed 40,000,000 acres. Canada has about a million square miles of standing timber and contains the largest white pine areas in the Western Hemisphere. The annual production of lumber aggregates $80,000,000 per year, about one-third of which is exported to the United States. Russia has the largest forest areas in the world, a total of 812,640,600 acres, three-fourths of which belong to the government. Forest fires and the clearing of the ground for cultivation are prolific sources of forest destruction. Great carelessness has been displayed in lumbering and in setting fires to brush left on the ground after the more valuable trees have been cut. However, the government has displayed much wisdom in protecting the forests and in encouraging schools of forestry.

FORESTERS, Ancient Order of, a fraternal organization founded in Yorkshire, England, in 1745. Though it has been maintained continuously since that time, its material growth dates from the early part of the 19th century. The first court was established in America in 1832, at Philadelphia, Pa., and since then it has spread rapidly in Canada and the United States. In 1923 it had about 9,500 courts, with 1,000,000 members, of whom about 50,000 were in Canada and the United States. Courts are maintained in 36 countries. It is one of the largest beneficiary societies of the world. The benefits distributed annually aggregate $5,000,000.

FORESTERS, Independent Order of, a society founded in 1874 at Newark, N. J. It was reorganized in 1881 and maintains courts in Canada, the United States, Great Britain, Australia, and other countries. The society has about 5,000 local courts, which are under the direction of high courts, and the general government is vested in a supreme court. The order is both fraternal and benevolent, has 240,000 members, and has disbursed in benefits about $49,500,000 since its organization.

FORESTERS OF AMERICA, a benevolent and fraternal society, reorganized under its present name in 1895. It originated from the Ancient Order of Foresters (q. v.), introduced in America in 1832, but separated from

(Opp. 1032)

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the mother organization in 1889. In 1922 it had 1,750 courts and 250,000 members. The annual payments as benefits approximate $1,125,000. Since its organization about $23,500,000 has been disbursed.

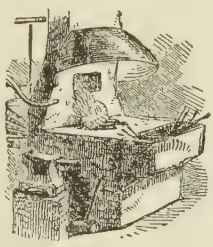
FORESTRY, the management and preservation of trees in communities. This branch of economic study is concerned with the planting of trees and the utilization of both cultivated and native forests with the view that the best possible good may be obtained. Man has been the worst enemy of forests in America since the discovery of this continent. Lumbering has greatly lessened the visible supply, but forests are also destroyed by insects, fungous diseases, drought, forest fires, and the grazing of animals. Attention has been directed to forestry both with the view of planting new forests and preserving old ones, and it is designed to prevent ruthless destruction as well as to utilize to the best advantage the supply of timber for fuel and for construction.

Forestry has been a branch of study in the institutions of Europe for many years, especially in Germany, whose foresters are considered the best prepared and most skillful in the world. The need of some rational system of forest management is recognized by the leading nations. Canada has forest reserves of about 12,500,000 acres and has a well-disciplined corps of officials to aid in diffusing knowledge of forestry and protecting the forests on the public lands. The Bureau of Forestry, established in 1901 under the Department of Agriculture, is an important branch of the government in the United States. The chief aim is to develop scientific forestry. In literature sent out by this bureau the benefits of studying forestry are shown, which include an investigation of climatic influences upon shrubs and trees.

Among the advantages of forests are that they conserve moisture and thereby increase rainfall. They temper hot and cold winds and are useful in reclaiming tracts of almost barren land. The benefits of wind-breaks are seen on the great prairies of Canada and the United States, where innumerable hedges and groves have been planted. Parks and clusters of trees furnish covering for birds and add to the enjoyment of man. The schools of forestry aid in studying the adaptation of various trees to particular localities, especially as they are influenced by soil, moisture, and temperature, and much valuable information has been given in regard to the selection of land for reforestization and the care to be given growing trees.

The interest in forestry is promoted not only by the general government, but likewise by the several states and minor subdivisions. In 1885 New York created a forest commission, and that State has a reservation in the Adirondack and Catskill regions amounting to 1,250,000 acres. Constitutional provisions for forestry have been made in many states, while in others the regulations are by legislative enactments. Colleges of agriculture have placed forestry in the regular courses and the American Forestry Association has promoted interest by holding meetings and issuing reports.

FORGE (fōrj), an open fireplace or hearth with forced draft for heating iron, steel, or other substances. The term is also applied to a workshop where metals are hammered and shaped by the aid of heat. Forges were formerly made of brick, with a large leather bellows to furnish the blasts of air, but at present are made largely of iron and the blast of air is obtained from a rapidly rotating fan wheel. All heavy forging is done by hammers run by machinery. In the great Krupp works at Essen, Germany, is the largest forge hammer in the world. It is constructed so skillfully that it can be manipulated to gently crack a small nut or sufficiently forceful to crush a thick bar of iron.



BLACKSMITH'S FORGE.

PORTABLE FORGE.

FORGERY (fōr'jĕr-ў), in law, the act of falsely making or materially altering a writing or written instrument, with intent to defraud. Forgery consists essentially in making a false instrument appear to be legal and genuine. It is a grave offense, punishable by fine or imprisonment in the penitentiary. The national governments of all countries provide punishment for forgery by legal enactments, and additional protection is provided by laws in the states and provinces. In most countries the Federal government has exclusive jurisdiction of cases which arise from forging, uttering, or publishing as true any papers relating to the nation, while the states and provinces have jurisdiction of those arising under their laws. The false making or altering of papers with intent to defraud are not the only defenses that come under the head of forgery, but such offenses as changing records and altering brands or stamps are included.

FORGET-ME-NOT (fôr-gĕt'mē-nŏt), a genus of plants generally diffused over the North Temperate Zone. The flower is small and is blue in most species. It has five petals and a salver-shaped corolla. On account of its brilliancy of color, and, being the emblem of constancy in friendship and love, it is a favorite flower in most countries. The dark blue

forget-me-not of the Azores is cultivated extensively. The present name is from the German *Vergiss-mein-nicht,* while the former English name, *scorpion grass,* is rarely used.

FORKS. See **Cutlery.**

FORLORN HOPE (fôr-lôrn'), a military term applied to a body of men selected from an army for the performance of some exceptionally dangerous duty, such as leading the assault upon a fortress or heading a perilous charge in battle. Those who undertake such a task usually are volunteers, and a liberal reward is generally given to those who survive.

FORMALDEHYDE (fôr-măl'dē-hīd), a colorless, volatile liquid, chemically intermediate between formic acid and mythol alcohol, discovered by Hofmann in 1867. It is used in making dyes and as a disinfectant.

FORMIC ACID (fôr'mĭk), a simple fatty acid of organic chemistry, so named from its being found in the bodies of ants. It is prepared artificially by dissolving sugar, starch, or tartaric acid in water, then adding sulphuric acid, and distilling the mixture on peroxide of manganese. Pure formic acid solidifies at a low temperature, forming a crystalline mass. It is strongly acid, colorless, and transparent, and has a pungent odor. It is very corrosive and, when placed on the skin, causes intense irritation.

FORMOSA (fôr-mō'sà), or **Taiwan,** an island lying off the eastern coast of China, in the Pacific Ocean. It is separated from the province of Fo-Kien by a strait about 85 miles wide. The island has a length of 240 miles, an average breadth of 72 miles, and an area of 13,418 square miles. The surface is mountainous, especially in the interior. Mount Morrison is the culminating peak, having a height of 14,360 feet. A part of the surface is made up of barren clay hills, but the plains and valleys are fertile. Among the principal products are sugar, rice, silk, tea, tobacco, camphor, vegetables, coal, and fruits. The climate is favorable and healthful and the rainfall is abundant. Formosa was opened to foreign trade by the Treaty of Tien-tsin in 1858, when Takow, Tainan, Anping, and Tamsui were made free ports. Japan, China, and Great Britain have the principal part of the trade.

China undertook to explore and settle Formosa as early as 603. The Dutch controlled a large portion of the island in the 17th century, but it remained a Chinese territory the greater part of the time. About 500,000 Chinese immigrants settled in the western portion during the Chinese occupation of the island. They greatly modified the industries which prior to that time were under the exclusive control of the Malays. After the war between China and Japan, in 1895, it was ceded to the latter country by treaty, and now constitutes a Japanese possession. A native revolt occurred in 1897, but it was suppressed by the government, and local officials were enjoined to show a spirit of fairness and benevolence in the administration of public affairs. Many schools and public institutions have been established by the Japanese. The native inhabitants are chiefly Hakkas and the aboriginal tribes and clans. Population, 1922, 3,581,962.

FORREST (fŏr'rĕst), **Edwin,** noted tragedian, born in Philadelphia, Pa., March 9, 1806; died there Dec. 12, 1872. He first played on the stage in 1820. Six years later he appeared at the New York Bowery Theater, where he made a signal success in the character of *Othello.* In 1836-37 he played with success in London and afterward visited other European cities. He made a second visit to London in 1845 in company with his wife and performed at the Princess' Theater. His successes were principally as *King Lear, Richard III.,* and *Coriolanus.* Intense jealousy arose between Forrest and Macready, the favorite actor of the English stage, which caused the former to lose favor in Britain. In 1849 Macready played in New York City, which gave rise to a riot and resulted in the death of twenty rioters. For this affair Forrest was criticized severely, although it was due rather to the native American spirit of the period rather than to any fault on his part. He made his last appearance on the stage at Boston in 1871. His success as an actor is attested by universal approval and an accumulation of a fortune amounting to $1,000,000. After leaving the stage, he built a beautiful mansion on the banks of the Hudson, erected an imposing house in Philadelphia, and left his fortune chiefly for the purpose of founding a home for poor members of his profession.

FORREST, Sir John, explorer, born in Western Australia, Aug. 22, 1847. He was educated at Perth, where he attended the Bishop's School, and in 1865 entered the survey department of Western Australia. In 1869 he commanded an exploring expedition into the interior, and the following year explored the region from Perth along the south coast to Adelaide. He showed that it was practicable to construct a telegraph line across the continent, and the government acted upon his suggestion in 1876. In 1874 he explored the region between Adelaide and Port Darwin, making a journey of nearly 2,000 miles. For these services he received the gold medal of the Royal Geographical Society of London. In 1887 he represented Western Australia at the colonial conference in London. He was chosen Minister of Defense of the Commonwealth of Australia in 1901 and three years later became Minister of State for Home Affairs. He published "Explorations in Australia."

FORREST, Nathan Bedford, soldier, born in Bedford County, Tennessee, July 13, 1821; died in Memphis, Oct. 29, 1877. He first engaged in the occupation of a planter, became a

slave dealer, and in 1861 raised a cavalry regiment to defend Fort Donelson for the Confederates. During the war he fought at Shiloh, Murfreesboro, and Chickamauga, became major general, and in 1864 captured Fort Pillow by a skillful assault. Soon after he was promoted lieutenant general. He was defeated by General Wilson in 1865 and surrendered a month later at Gainesville. Subsequent to the war he engaged in several railroad enterprises.

FORSTER (fôr'stĕr), **Johann Reinhold,** traveler and naturalist, born in Dirschau, Germany, Oct. 22, 1729; died Dec. 9, 1798. He entered upon the study of theology at Halle and was ordained pastor at Nassenhuben, but continued to pursue his favorite studies of geography, mathematics, and history. In the second voyage of Captain Cook, he accompanied that navigator around the world and made many valuable researches. His description of the voyage was published in 1777. He became professor of natural history at Halle in 1780, where he labored in that capacity until his death. Among his writings are "History of Northern Discoveries," "Researches for Truths," and "Zoölogical Research."

FORSTER, John, political and historical writer, born in Newcastle, England, April 2, 1812; died Feb. 1, 1876. He was the son of a Unitarian and secured a good education in mathematics and the classics. In 1832 he published "Lives of Eminent British Statesmen." Among his writings are "Life of Dickens," "Life and Times of Oliver Goldsmith," "Debates on the Grand Remonstrance," and "Life of Swift."

FORT COLLINS, county seat of Larimer, Colorado, 74 miles north of Denver, on the Cache la Poudre River and on the Union Pacific and other railroads. The features include the high school, federal building, Y. M. C. A., public library, and Colorado State Agricultural College. It has gas and electric plants, street railways, and a large trade in merchandise and farming produce. The place was settled in 1864 and incorporated in 1873. Population, 1910, 8,210; in 1920, 8,755.

FORT DEARBORN. See **Dearborn, Fort.**

FORT DODGE, a city of Iowa, county seat of Webster County, on the Des Moines River, about 85 miles northwest of Des Moines. It is on the Chicago Great Western, the Illinois Central, the Minneapolis and Saint Louis, and other railroads. It is the seat of Tobin College and Lutheran and Catholic hospitals. The features include the post office, the county courthouse, the public library, the high school, the First National Bank, and a number of fine churches. Among the manufactures are flour, ironware, clothing, oatmeal, tile, pottery, stucco, and machinery. The surrounding country is fertile, possesses extensive dairy interests, and is rich in coal, gypsum, and clay deposits. Among the municipal facilities are paved streets, waterworks, electric and gas lighting, and a system of sanitary sewerage. It has a large trade in cereals and merchandise. Population, 1905, 14,369; in 1920, 19,333; in 1925, 21,702.

FORT DUQUESNE (dụ-kān'). See **Pittsburg.**

FORT ERIE. See **Erie, Fort.**

FORT FISHER (fĭsh'ẽr), a fortress below Wilmington, N. C., at the entrance to Cape Fear River. General Butler led a force of 6,000 men against the fortress in December, 1864, and was aided by Admiral Porter with a fleet of ironclads. The project of taking the fortress was abandoned after two days, but on Jan. 13, 1865, a second attempt was made by General Terry and Admiral Porter, which resulted in its capture. The Union army took 2,000 prisoners and 170 heavy guns.

FORTH, a firth and river of central Scotland, formed by the confluence of the Dhu and Duchray in Perthshire. The river is 170 miles long and merges into the Firth of Forth, a body of water extending fifty miles east from Alloa to the North Sea. It has important salmon and herring fisheries. The celebrated Forth Cantilever Bridge, a railway viaduct at Queensferry, is 4,000 feet long. This bridge is 8,295 feet, or about a mile and a half long, and the cantilevers cover about one mile. It was completed in 1889 at a cost of $13,000,000.

FORTS HENRY AND DONELSON, two forts erected by the Confederates in Tennessee, near the border of Kentucky. Fort Henry was located on the Tennessee River, about twelve miles from Fort Donelson, which was on the Cumberland River, being about forty miles from where these rivers flow into the Ohio. They were strongly manned in 1861 and constituted important strategic points, since they controlled the entrance into the Southwest by means of the Cumberland and Tennessee rivers. General Grant, assisted by a river fleet under Commodore Foote, decided to attack Fort Henry on Feb. 2, 1862. On the 6th Commodore Foote made a vigorous attack and compelled the surrender of the works, but the Federal military forces were delayed and the Confederate garrison meanwhile escaped to Fort Donelson. General Grant made a vigorous attack upon the latter on Feb. 13, 1862. Two days later General Buckner addressed a communication to General Grant in which he requested that a commission be appointed to settle upon terms of capitulation. To this Grant sent his famous reply: "No terms except unconditional and immediate surrender can be accepted. I propose to move immediately upon your works." The terms were accepted by Buckner, who surrendered 14,000 prisoners.

FORTIFICATION (fôr-tĭ-fĭ-kā'shŭn), a military defensive work, erected for the purpose of strengthening a place or position. The term also applies to the science of fortifying a position in such a way that it may be held by a body of men much inferior in numbers to

their assailants. It implies a knowledge of the resistant power of materials as well as advantage in positions, so the construction may be devised in a manner that the enemy in attacking must of necessity suffer great loss. Defensive works are either regular or irregular as to construction, and, with respect to time, are distinguished as *permanent* and *temporary,* or *field,* fortifications.

The history of fortifications is as old as that of offensive and defensive warfare, though the process of construction has undergone numerous modifications, which were necessitated largely by the modern improvements in the implements of war. The student of history finds numerous references to defensive fortifications as the different peoples are studied. Thus, we recall the story of Troy, in which it is related that the city stood safely against the Grecians until the colossal wooden horse was taken within its walls against the admonition of Laocoön. The walls of Babylonia were 32 feet thick, 100 feet high, and strengthened by great towers. The walls of Jericho resisted the invading hosts of Israelites, and, according to the Scriptures, crumbled before them only after divine aid was extended. Many ancient walls of Asiatic cities still remain. Though having answered a good purpose in resisting the attacks with battering rams and ancient implements, they serve but illy when brought to a test against modern ordnance.

Soon after gunpowder became known to the Europeans, the modern nations began to devise new implements of war, and likewise sought to counteract their effect by powerful works of defense. The Italians began in the 15th century to construct bastions, while the French engineer, Sébastian de Vauban (1633-1707), who served under Louis XIV., developed the *bastion system* to such an extent that it still prevails in France as the general type of fortifications. However, this system has given way largely in most countries to the German *polygonal system,* which is sometimes called the caponiere system on account of employing numerous caponieres to span ditches, thus utilizing them instead of bastions for defensive purposes.

In constructing field fortifications, engineers take advantage of position with the view that the enemy will be exposed to fire and cross fire in making the attack. The general plan aims to require a hazardous march across an open field, in which those within the line of fortifications may at an advantageous time send forth detachments to make counter charges. Among the field fortification works are the *redan,* which forms an angle in front of the enemy. It has two parapets protected by a ditch; the redoubt, an inclosure with a parapet and ditch encircling it; and the lunette, a redan construction with numerous short flanks. These works are so constructed that they flank each other within the range of rifle fire, and are further strengthened by entrenched camps and by a series of rectangular or square redoubts. In case the time to construct is limited, such simple entrenchments as shelter trenches are speedily thrown up. These temporary forms consist of earth thrown toward the front, back of it being a ditch in which the rifleman lies securely protected from the fire of lighter implements. An abatis of felled trees and barbed wire fences is effective in impeding the advance of the enemy. Barbed wire has been used extensively for this purpose within recent years.

The fortifications of seaports are quite different from those constructed for the defense of interior positions. Heavy ordnance which throw dynamite shells and other powerful explosives a distance of six or eight miles have made it necessary to greatly revolutionize defensive warfare. The largest guns obtainable are securely mounted, and by means of them the enemy's ships can be reached by the most powerful explosives and leaden balls. For additional protection the enemy's ships are watched with the aid of powerful electric lights and swift steamers are utilized to scout. In many instances torpedoes plow under the water, by which it is aimed to strike the enemy's ships from below. The outer defensive works consist of submarine mines, which are set off by the enemy's ships, or by means of electric connection from the shore.

Permanent fortifications are constructed of massive stone and iron works and are designed to defend important cities or strategic points. It is doubtful whether any fortress can be built that would form a serious obstacle to a modern land and naval attack, if the assailants were supplied with the most powerful modern guns. The greatest fortress in the world is the celebrated stronghold of Gibraltar, on the coast of Spain. It is considered impregnable to military assault, though this is due to its natural situation rather than to its artificial strength. Since modern guns have been able to obliterate practically all the older forms of fortresses, the newer are designed for offensive action rather than great strongholds of defense. They are constructed on the spherical plan, supplied with guns of the heavier caliber, and designed for special effect against ricochet firing. Places permanently fortified are inclosed by *ramparts;* the upper surface, called the *terreplein,* serves as the location of troops and cannon. *Parapets* or *breastworks* protect the terreplein against the fire of the enemy, while *embrasures,* through which the guns are fired, pierce the parapets at convenient intervals. *Ditches* about twelve feet in depth are excavated outside the rampart, often filled with water, and rendered serviceable in delaying the enemy's advance, along with wire fences and by other obstructions. The United States has permanent seacoast defenses at about forty localities. They include

Hampton Roads, Va., Boston, Mass., New York, N. Y., Washington, D. C., Charleston, S. C., Key West, Fla., New Orleans, La., Galveston, Tex., San Francisco, Cal., and the mouth of the Columbia River, Ore. and Wash. Many cities and seaports of Canada are protected by fortifications, of which those at Quebec, Quebec, Esquimault, British Columbia, and Halifax, New Brunswick, are the most noteworthy. Indeed, Halifax is the chief naval station of the British in North America. It is defended by eleven forts and batteries, one of which, the Citadel, is counted, next to Quebec, the strongest fortification in America.

FORT MADISON (măd'ĭ-s'n), a city in Iowa, county seat of Lee County, on the Mississippi River, eighteen miles southwest of Burlington. It is on the Chicago, Burlington and Quincy and the Atchison, Topeka and Santa Fé railroads. Among the chief buildings are the county courthouse, the State penitentiary, the Catermole Memorial Library, and the high school. The manufactures include furniture, machinery, woodenware, flour, boots and shoes, paper, and leather. It has electric lighting and other public utilities. The city has an important trade in farm produce and merchandise. It was settled in 1832 and incorporated in 1836. Population, 1925, 11,229.

FORT MIMS, Massacre of, an assault during the Creek War, Aug. 30, 1813, at Fort Mims, about 35 miles north of Mobile, Ala. The fort was a temporary stockade under command of Dixon Bailey and about 550 persons had assembled there for protection. Weathersford, a half-breed, made an attack with a force of Indians. The fort made a vigorous defense, but was overpowered by superior numbers, and only fifteen escaped, all the others being massacred.

FORT MONROE (mŭn-rō'), or **Fortress Monroe,** the strongest fortification in the United States, situated on Hampton Roads, Virginia. It was erected for the defense of the Norfolk navy yard, on the coast of Virginia, and occupies a fine site at Old Point Comfort. The plans and construction were completed under a French engineer. It is on a reservation of 282 acres and has within it detached buildings for workshops, barracks, officers' quarters, storehouses, and an artillery school. Many tourists visit the place, owing to its fine climate and extensive hotel, railway, and steamboat connections. In the Civil War it was an important Confederate stronghold. Jefferson Davis was imprisoned for two years at Fort Monroe after the war closed.

FORT MOULTRIE (mōl'trĭ), a fortification situated on Sullivan's Island, near the entrance to Charleston harbor, South Carolina. The fort was originally constructed of earth and logs, but was afterward rebuilt in masonry. A British fleet made an unsuccessful attack upon it in 1776. It was then known as Fort Sullivan and was defended by 6,500 Americans, of whom 435 were stationed at the fort. The British fleet under Sir Peter Parker and a force of regulars under Sir Henry Clinton made a combined attack, but they were compelled to abandon the invasion of the South. However, it surrendered to the British on May 7, 1780. The name was changed during the Revolutionary War to Fort Moultrie in honor of Col. William Moultrie, who defended it at the beginning of the war. In December, 1860, it was abandoned by Major Anderson, when it fell into the possession of the Confederate forces.

FORT NIAGARA (nī-ăg'ā-rà), a fort near the mouth of the Niagara River, on the American side, located by La Salle as a fortified trading post in 1669. This was afterward destroyed and abandoned and Fort Niagara was built on the same place by the French in 1725. The English under Sir William Johnson captured it during the French and Indian War, in 1759, hence the French were cut off from all their posts in the interior. During the American Revolution it was a center of British influence, whence many expeditions were sent to points farther south. It was evacuated by the British in 1796 as provided in the Treaty of 1783 and became the seat of an American garrison. In 1813 it was captured by the British, who crossed over from Canada and made a night attack upon the fort, but in 1815 it was again surrendered to the United States. It ceased to be a fort in 1826, when the Federal garrison was withdrawn.

FORT PICKENS (pĭk'ĕnz), a fort in Florida, on Santa Rosa Island, at the entrance of Pensacola Harbor. A Federal force under Adam J. Slemmer was in possession of the fort at the beginning of the Civil War, and was besieged by the Confederates under Braxton Bragg. In April, 1861, reënforcements were sent to relieve the fort and it was held by the Federals throughout the war. Fort Pickens is a defense to the United States navy yard at Warrington.

FORT PILLOW, a fort on the Mississippi River, in Tennessee, forty miles north of Memphis. It was so named from General Pillow, under whose direction it was constructed by the Confederates in 1862, but a small Federal force captured it soon after. General Forrest made an attack upon it April 12, 1864, and the garrison was reduced after stubborn resistance. It was asserted that many of the Federals, about half of whom were Negroes, were massacred after they had surrendered, but this charge was denied by the Confederates on the ground that the garrison conducted a reckless defense, hence many of the soldiers were killed after resistance was futile.

FORT SCOTT, a city in Kansas, county seat of Bourbon County, on the Marmaton River, 98 miles south of Kansas City. It is on the

Missouri Pacific, the Kansas City Southern, and other railroads. The surrounding country is fertile and contains valuable deposits of cement rock, flagstone, and bituminous coal. A system of street lighting, three parks, much street paving, and a city library are among the facilities. The public buildings include a United States courthouse and post office, a high school, Mercy Hospital, and many church and business buildings. The manufactures include woolen goods, sugar, canned milk, clothing, flour, machinery, soap, bread, and sorghum. It was settled in 1838 and incorporated as a city of the first class in 1883. Population, 1904, 14,081; in 1925, 11,763.

FORT SMITH, a city in Arkansas, county seat of Sebastian County, on the Arkansas and Poteau rivers, 130 miles northwest of Little Rock. It is on the Kansas City Southern, the Saint Louis and San Francisco, and other railroads. The chief buildings include the county courthouse, the United States customhouse, the high school, and the public library. It is the seat of a United States district court. The manufactures include cotton seed oil, cigars, furniture, ice, cotton goods, and machinery. Electric lights, rapid transit, pavements, and waterworks are among the improvements. It was settled in 1838, incorporated as a town in 1842, and chartered as a city in 1886. Population, 1900, 11,587; in 1925, 37,012.

FORT STANWIX (stăn'wĭks), a fort built by the English under Brigadier Stanwix in 1758, on the site occupied by Rome, N. Y. It was an important strategic point, owing to its location on the principle route between Canada and points in the State of New York. In 1768 Sir William Johnson made a treaty at this place with the Six Nations, who surrendered title to a large part of the region now included in West Virginia, Kentucky, and Pennsylvania. It was rebuilt in 1776 and named Fort Schuyler. The following year it was attacked by a British force under Saint Leger, who had advanced from Canada. See **Oriskany, Battle of.**

FORT SUMTER (sŭm'tẽr), a fortification situated at the entrance to Charleston harbor, South Carolina, and named after Thomas Sumter, an American leader in the Revolutionary War. South Carolina seceded in December, 1860, and Major Anderson, the commanding officer, abandoned the adjacent forts and occupied Fort Sumter with 100 men and 52 light guns. General Beauregard led an attack on the fort April 12, 1861, and two days later it was compelled to surrender. This event was the beginning of the Civil War, and the news of it immediately spread the fire of enthusiasm over the entire North and brought that section to arms. The Confederates held the fort until after the evacuation of Charleston, but surrendered it on April 14, 1865, four years after its capture. Soon after the loss of Fort Sumter to the Confederates, Richmond was evacuated, the Confederate forces surrendered, and their cause was entirely abandoned. Since the Civil War it has been rebuilt and greatly improved.

FORTUNA (fôr-tū'nä), the Roman goddess of chance, called Tyche by the Greeks. She personified the combination of circumstances which we call luck or fortune. It was supposed that she smiled at the birth of the successful, and frowned on those whose efforts resulted in failure. Temples were built to her at Corinth, Smyrna, and Elis, and statues were erected at Antium. In her temple at Thebes she is represented holding the infant Plutus in her arms to symbolize her power over riches and prosperity. According to a Roman legend, she put off her wings and shoes, and threw away her rudder when entering the capital, as an indication that she meant to dwell in the Eternal City forever.

FORTUNY Y CARBO (fôr-tōō'nē ē kär-bō'), **Mariano,** famous painter, born in Reus, Catalonia, Spain, June 11, 1838; died in Rome, Nov. 21, 1874. His careful work at the Academy of Barcelona secured a prize and permitted him to pursue further study in Rome in 1858. Besides his extensive and valuable paintings in oil, he produced numerous productions in etching and in water colors. Among his best known pictures are "Amateur of Prints," "Book Lovers in the Library of Richelieu," "The Sword Sharpener," "Fantasia Morocco," and "A Spanish Marriage." The last named painting was suggested by the occasion of his wedding.

FORT WILLIAM, a city of Thunder Bay District, Ontario, on the Kaministiquia River, near Lake Superior, and on the Canadian Pacific, the Canadian National, and intercity electric railroads. It has grain elevators, gas and electric plants, brick yards, railroad shops, stove works, and wood working factories. The wholesale trade is extensive. Among the features are the city hall, courthouse, Y. M. C. A., high school, public library, and many fine churches. It was founded in 1801 by the Hudson Bay Company. Population, 1921, 20,541.

FORT WAYNE (wān), a city of Indiana, county seat of Allen County, on the Maumee River and the Wabash and Erie Canal, about 150 miles southeast of Chicago, Ill. It is on the Wabash, the Pennsylvania, the New York Central, the New York, Chicago and St. Louis, the Grand Rapids and Indiana, and other railroads, and is the converging center of several electric interurban railways. Among the noteworthy buildings are the county courthouse, the Carnegie public library, the Federal building, the Concordia College (Lutheran), the Indiana School for Feeble-Minded Youth, and a Roman Catholic academy. The architecture is modern and substantial, including many tall office, bank, and hotel buildings. It is surrounded by a productive farming

country and has a large wholesale and jobbing trade. Among the chief manufactures are agricultural implements, furniture, steam engines, car wheels, electrical apparatus, leather, stoves, woolen goods, and hardware. It has extensive systems of sewerage, stone and macadam paving, waterworks, and gas and electric lighting. Fort Wayne was so named from Gen. Anthony Wayne, who built a fort here in 1794, and a monument has been erected to his honor. It was chartered as a city in 1839 and became prosperous in 1840, after the completion of the Wabash and Erie Canal. Population, 1900, 45,115; in 1920, 86,549.

FORT WORTH, a city of Texas, county seat of Tarrant County, at the junction of the West and Clear forks of the Trinity River, 170 miles north of Austin. It is on the Forth Worth and Denver, the Texas and Pacific, the Chicago, Rock Island and Pacific, the Gulf, Colorado and Santa Fé, and other railroads, and is connected with Dallas, thirty miles east, by an electric railway. The Clear River and numerous artesian wells furnish an ample supply of water for manufacturing and sanitary purposes. An extensive street railway system penetrates all parts of the city, while electric lighting, waterworks, public libraries, and an excellent school system are among the general facilities. It is the seat of the Natatorium, a bathing establishment costing $50,000. Among the educational institutions are the Texas Christian University, the Texas Woman's College, the Baptist Seminary, and a Roman Catholic academy. The city hall, courthouse, high school, and chamber of commerce building are convenient and costly edifices. It has manufactures of wire, flour, hardware, jute, clothing, cotton and woolen goods, leather, and machinery. Fort Worth has a large trade in farm produce, live stock, and merchandise. It was settled in 1849 and incorporated in 1872. Population, 1900, 26,688; in 1920, 106,482.

FORUM (fō′rŭm), in Roman history, a public place or square in a city where markets and public assemblies were held and where justice was administered. The most noted in Rome was the Forum Romanum, situated between Mount Palatine and the Capitoline Hill, which was adorned with exquisite statuary and magnificent buildings, and beautified by foliage, flowers, and walks. The government of Italy has recently made excavations and is preserving the more valuable relics for study. Legally, the term *forum* implies a court where an action may be instituted.

FOSSILS (fŏs′sĭls), the organic bodies that were buried in past ages by deposits of earth, and which preserved their form or substance so as to be capable of identification. The term is also applied to indentations made by animals on rocks while forming, as the imprints of birds walking on pasty deposits. Some fossils consist of vegetable and animal parts in a good state of preservation, as the trunks of trees or the bones, teeth, and horns of animals, and the shells of mollusks. The process of fossilization is due to the decomposition of the least permanent in the organic structure and its replacement with some mineral matter. In some cases new material is substituted for the entire decomposed mass, while in others the organic remains are preserved in an almost perfect state. Shells, wood, and other substances are frequently changed into various siliceous fossils by subjecting the organism to the action of water containing silica in solution. Similar results take place when the mineral matter is iron oxide, pyrite, or calcium carbonate, while in rare cases barite and flourite have a like effect. When the organic portions pass away in decay, the mineral matters slowly take their place.

Fossil footprints of extinct animals have been discovered in the Triassic and Carboniferous rocks of Eurasia and in the Cambrian, Silurian, and Carboniferous of America. The imprints are largely those of birds, reptiles, mollusks, fish, and insects, and were made either by the feet in walking or by the body in making impressions in the mud after death. Fossil botany now includes many extinct plants, among them those of the Dakota group of cretaceous deposits, found in America; those of the Fayette formation, and those of the Florissant, found in Colorado, each of these including a large number of species. Among the recent publications on this subject are F. H. Knowlton's "Catalogue of Cretaceous and Tertiary Plants of North America" and A. C. Seward's "Fossil Plants for Students of Botany and Geology."

FOSTER (fŏs′tẽr), **Charles,** statesman, born at Tiffin, Ohio, April 12, 1828; died Jan. 9, 1904. After securing an education, he engaged as a merchant and banker in Fostoria, Ohio. He was elected to Congress as a Republican in 1870, and subsequently was reëlected three times. While on the Ways and Means Committee, he secured a thorough investigation of the Sanborn frauds and induced the repeal of the Moiety law. In 1874 he investigated certain electoral frauds at New Orleans, and in his official report denounced the acts of both political parties in Louisiana. In 1880-84 he was Governor of Ohio, and in the administration of President Harrison was Secretary of the Treasury, beginning in 1891.

FOSTER, George Eulas, statesman, born in Carleton, New Brunswick, Sept. 3, 1847. He attended the schools in his native town, graduated in the University of New Brunswick in 1868, and for three years taught school at Fredericton. Subsequently he studied at Edinburgh and Heidelberg, and in 1871 was made professor of classics and history in the University of New Brunswick, in which he taught successfully until 1879. He became a member

of the Canadian House of Commons in 1882, was made Minister of Marine in 1885, and in 1888 was chosen Minister of Finance in the Cabine . As a scholar and statesman he exercised a wide influence, and in the Bering Sea fisheries dispute he did much toward furthering the interests of Canada. He published a number of pamphlets relating to temperance and political questions.

FOSTER, John Watson, statesman, born in Pike County, Indiana, March 2, 1836. He graduated from the State University of Indiana in 1855, studied law at Harvard, and entered upon the practice of law in Evansville, Ind. Soon after the beginning of the Civil War he entered the service as major. President Grant appointed him minister to Mexico in 1873, and in 1880 he was made minister to Russia. Later he served as minister to Spain. In 1892 he succeeded J. G. Blaine as Secretary of State, represented the United States at Geneva in the Bering Sea arbitration in 1893, and in 1895, was selected by the Emperor of China to treat with Japan as peace commissioner. He negotiated a treaty with much ability, which was promptly ratified as the Treaty of Shimonoseki. In 1898 he was appointed a member of the Anglo-American joint high commission, which was created that year. He published "A Century of American Diplomacy." He died Nov. 15, 1917.

FOSTER, Murphy James, public man, born at Franklin, La., Jan. 12, 1849. He studied at Washington and Lee University, graduated at Cumberland University in 1870, and subsequently studied law at Tulane University. For some years he practiced his profession in his native town. In 1880-92 he was a member of the State Senate and was prominent as an opponent of the Louisiana State Lottery. He was Governor of the State in 1892-1900. In the latter year he was elected to the United States Senate. He died June 12, 1921.

FOSTER, Randolph Sinks, Methodist Episcopal bishop, born in Williamsburg, Ohio, Feb. 22, 1820; died May 1, 1903. He was educated at Augusta College, Kentucky, becoming a minister in 1837, and secured a charge in the Kentucky conference. Subsequently he labored in Ohio and New York, and from 1857 until 1860 was president of the Northwestern University in Evanston, Ill. Later he served as pastor in New York and Sing Sing and became bishop in 1872, making visitations in Europe and several of the South American republics. His publications include "Christian Purity," "Beyond the Grave," "Study in Theology," "Minister for the Times," and "Centenary Thoughts for the Public and Pew of Methodism."

FOSTER, Stephen Collins, song and ballad writer, born in Pittsburg, Pa., July 4, 1826; died at New York, Jan. 13, 1864. He was related by marriage to President Buchanan, possessed a fair knowledge of German and French, and began writing songs at the age of thirteen. He composed 125 popular songs, a large portion being melodies in the Negro dialect. Among the best known are "Sadly to Mine Heart," "Nellie Was a Lady," "Come Where My Love Lies Dreaming," "Old Dog Tray," "Massa's in the Cold, Cold Ground," "Old Kentucky Home," and "Old Folks at Home." His songs became popular from the first and were a source of profit to him, his "Old Folks at Home" bringing him about $15,000.

FOSTORIA (fŏs-tō′rĭ-ȧ), a city of Ohio, in Seneca County, about twelve miles west of Tiffin. It is on surfaced highways, the Nickel Plate, the Baltimore and Ohio, and other railroads, and has a large trade in produce and merchandise. The surrounding country is fertile, producing cereals and fruit, and gas and oil fields are worked in the vicinity. Among the noteworthy buildings are the high school, the city hall, the post office, and several churches. The manufactures include flour, cigars, machinery, glass, and utensils. Gas and electric lights, street railways, waterworks, and fine school buildings are among the improvements. Fostoria was named from the father of Charles Foster, who was Governor of Ohio. The present charter dates from 1889. Population, 1900, 7,730; in 1920, 9,987.

FOUCAULT (fōō-kō′), **Jean Bernard Léon,** physicist, born in Paris, France, Sept. 18, 1819; died Feb. 11, 1868. He studied medicine in his native city, but gave his attention chiefly to physical research. In 1844 he invented an apparatus used in making optical experiments by means of electric light. Soon after he demonstrated the rotation of the earth on its axis by the pendulum and gyroscope. In 1854 he was made physicist in the Imperial Observatory, and his method of measuring the velocity of light secured for him the Copley medal. He is the inventor of the Foucault polarizing prism.

FOUCHÉ (fōō-shȧ′), **Joseph, Duke of** Otranto, minister of police under Napoleon I., born near Nantes, France, May 29, 1763; died in Trieste, Austria, Dec. 25, 1820. He was educated in Paris, lectured in the colleges of Juilly, Arras, and Vendôme, and subsequently became an advocate. In 1792 he succeeded in an election to the national convention. He advocated the execution of Louis XVI., was nominally implicated in the atrocities of the period, and was expelled from the national convention in 1794. Later he became ambassador to Milan and then to Holland, but shortly after was recalled to Paris and appointed minister of police. Napoleon dismissed him twice on account of mistrust, but each time renamed him for the place. When the titles of nobility were revived, he was made Duke of Otranto. After the fall of Napoleon, he was given office by Louis XVIII., but was soon after dismissed

and banished with all those who had voted for the death of Louis XVI. Subsequently he settled at Prague, where he became a citizen of Austria.

FOULKE, William Dudley, lawyer and author, born in New York City, Nov. 20, 1848. He studied at Columbia University, was admitted to the bar in 1871, and began a successful practice in New York City. In 1876 he removed to Richmond, Ind., where he was a railroad attorney, and in 1888 edited the *Palladium.* From 1882 until 1886 he was a member of the State Senate of Indiana, where he was influential as a civil-service reformer. His publications include "Civil-Service Reform, its Labor Aspects," "Proportional Representation," "The Silver Question," "The Theory and the Practice of Civil-Service Reform," and "A Study of the Growth and Tendencies of Russian Civilization."

FOUNDRY (found'rĭ), an establishment which is supplied with the necessary machinery to melt and mold cast iron and other metals on a large scale. Foundries are usually located near the blast furnaces, or have such furnaces within the main or adjacent buildings, and from these the products of pig iron are obtained for the second fusion, which is the special object of the foundry. The process of shaping metallic figures is done by pouring the molten materials into molds in which it cools and solidifies. This operation is called *founding* or *casting* (q. v.). The mold used is usually in two parts, one containing the pattern, which is surrounded by a fine molding sand, and the other part is tightly fitted to it. When the pattern is completely packed, it is removed carefully, leaving the sand so it forms a perfect mold for the object to be cast. The molten metal is poured into ladles, by which it is transmitted into the mold through small holes made through the sand. Much care is required in founding complicated parts of machinery. The manufacture of stoves, hollow ware, and various castings for machinery comprise the more important products of foundries. See **Casting; Furnace.**

FOUNDLING HOSPITAL, an institution for the reception and support of deserted children. Two classes are maintained, those supported by the government and those depending for support on private or sectarian aid. Abandoned children are known as *foundlings,* and the cause of their desertion is in most cases illegitimate birth, though quite a number are abandoned as a result of poverty or unhappy wedlock. Formerly the county poor farm was the only place provided for foundlings, but more recently better provisions have been made, especially in the larger cities, where foundling hospitals are very essential. The death rate in these institutions on an average is about 75 per cent., though it is frequently much higher. This is due to the circumstance that children received there are not in a good state of health, or are weakened by the anxiety and poverty of the mother. Children receive careful medical treatment and those that survive are usually placed in homes. The first foundling hospital was established in Milan, Italy, in 787. Soon after they became common in many cities of Europe. At present private or public institutions of this kind are maintained in many of the great cities of the United States and in some of the cities of Canada.

FOUNTAIN (foun'tĭn), an artificial basin containing water for drinking or other useful purposes, and connected by an arrangement of pipes through which water is forced to specific heights in ornamental jets. The pressure of the water at the head of the pipes is sufficient to cause it to rise to almost the same height at the orifice of issue. Many of the larger cities maintain elaborate fountains in public parks and squares for refreshing and ornamental purposes, while very beautiful effects are seen in connection with them at the great expositions. Among the most noted fountains are those at Rome, Berlin, and Paris. Those in Paris are mostly at the Place de la Concorde and at the Tuileries. The fountains seen at the international expositions are beautifully illuminated by electric lights, by means of which it is possible to secure elaborate color effects at night. Fine examples of these were furnished in the *Fountain of the Republic,* at Chicago in 1893; the fountains of *Man, Nature,* and *Progress,* at Buffalo in 1901; the *Cascades,* at Saint Louis in 1904; and the *Tower of Light Fountain,* at Philadelphia, in 1926.

FOUNTAIN OF YOUTH. See **Ponce de Leon.**

FOUQUE (fōō-kå'), **Freiderich Heinrich Karl,** poet and novelist, born at Brandenburg, Germany, Feb. 12, 1777; died Jan. 23, 1843. His father, a major general in the Prussian army, trained him for a military life. In 1792 he entered the army and served continuously until 1813, when he retired with the rank of major. He lectured on poetry and history a number of years. His "Sigurd the Snake-Killer" is a fantastic and humorous story. Other writings include "Seasons of the Year," "Dramatical Works," and "Spiritual Poems."

FOUQUET (fōō-kå'), **Nicolas,** statesman, born in Paris, France, Jan. 27, 1615; died Mar. 23, 1680. He descended from a noble family, was educated for the civil service, and held many important offices in Paris and under the government. In 1653 he became superintendent of finance, and succeeded in placing the government on a more stable financial basis. However, he incurred the disfavor of Colbert, who influenced the king against Fouquet, and he was subsequently arrested on a charge of malfeasance in office. He was adjudged guilty and consigned to the Bastile and was afterward condemned to banishment, but the sentence

was changed to life imprisonment. During his captivity, about fifteen years, he wrote a number of devotional works. He died while in prison at the fortress of Pignerol.

FOUR CORNERS, a locality in Elgin County, Ontario. General Proctor was stationed at this place with a British force and was attacked by the Americans under General Harrison on Oct. 1, 1813, a short time before the Battle of the Thames. The Americans were repulsed at Four Corners.

FOURIER (fōō-ryā'), **François Marie Charles**, socialist and founder of Fourierism, born in Besançon, France, April 7, 1772; died in Paris, Oct. 10, 1837. He studied at the place of his birth and later at Rouen and Lyons, where he showed aptitude in music and the sciences. On leaving school he became clerk in a mercantile house. Subsequently he entered business on his own account, but lost his money by reason of military disturbances and an insurrection in Lyons. During his leisure he wrote numerous books on social questions and founded the Fourier socialistic system. According to this system, harmony can be brought out of social discord by giving free play to all the feelings and p ssions of life. It designs to colonize mankir d in *phalanges,* each one a body of about 1,800 persons, divided according to affinities into groups of 24 to 32, constituted of persons attracted by one of the four affecting passions—*ambition, friendship, love,* and *familism.* Each of these groups should occupy a *phalanstére,* a highly cultivated self-supporting tract a league square. The members are to have their support from the result of the labors of all, and the residue is to be divided in twelve shares, three to be given as a reward for talent, four to capitalists, and five as a reward for labor. The system was tried in the United States and France and in both instances resulted in failure.

FOUR-O'CLOCK (fōr'ō-klŏk), an ornamental flowering plant native to Peru, but naturalized extensively in all the continents. It is so called because it blooms from about four o'clock in the afternoon until the next morning. Many varieties of colors have been obtained by cultivation. Most species are cultivated extensively in flowering beds and gardens. The calyx is often mistaken for a corolla, from its brilliance and calyxlike involucre.

FOWL, a term formerly used as a synonym of bird, but now restricted more particularly to the genus of birds known as *Gallus,* of which the East India jungle fowl is thought to be the original. The domestic fowl, including the cock and hen, belong to this class. That the domestication of fowls is of great antiquity is attested by figures on Egyptian monuments and the traditions of the Chinese, according to which they received their poultry from western countries as early as 1400 B. C. Among the best known species are the Leghorn, Spanish, Hamburg, Cochin, Brahma, Bantam, Plymouth Rock, Langshan, and Dorking. See **Poultry.**

FOWLER (fou'lēr), **Charles Henry,** clergyman, born in Burford, Canada, Aug. 11, 1837; died March 20, 1908. He removed with his parents to the United States in 1840 and graduated at Genesee College, New York, in 1859. Subsequently he attended the Garrett Biblical Institute, Evanston, Ill., and after graduating accepted an appointment as minister of the Methodist Episcopal Church in Chicago. In 1872 he was chosen president of the Northwestern University and, after serving efficiently for four years, he became editor of the *Christian Advocate,* the leading Methodist periodical in America. He was elected bishop in 1884, traveled in South America the following year as missionary, and in 1888 made a tour of visitation around the world. He founded a number of important institutions, among them the Nankin Wesleyan University in Central China. Besides lecturing and writing extensively, he published "Colenso's Fallacies."

FOX, an animal which is allied to the dog, having a long, bushy tail and erect ears. The pupil of the eyes is vertically elliptical. In all species the skull is rounded, the nose is very pointed, and the limbs are slender. However, they differ in size, color, and weight, but all exhibit the same artifices in obtaining prey and escaping danger. Foxes are so cunning that they are not easily caught in a trap. They burrow in the ground and live on animal food, unless pressed with hunger, when they feed on vegetable substances, especially seeds. Among the best known American species are the red, gray, cross, and Arctic foxes, which are hunted and trapped for their furs. The Arctic fox is smaller than the common fox, is pure white in winter, and abounds in the far north of the continent. It is gregarious and much more easily tamed than other species. Several species of the fox are found in Eurasia and Africa. Several kinds of foxes are reared for their fur on farms or ranches, such as the blue, the grey, and the silver foxes.

The cunning of the fox has caused it to enter largely as a popular figure into stories and fables. Some of these stories, especially those relating to its skill in getting food and in evading its enemies, are so remarkable that they are not universally believed. It is thought that this cunning developed as the result of the inherited experience of many generations. The cry is a yelping bark, but older ones learn to imitate the voice of other animals and use this means to decoy their prey. Some species live out in the woods, but most of them burrow in the ground, or select a deserted nest of a rabbit or a badger. The home of a fox usually consists of several rooms or compartments, such as an outer room or hole, a supply room, and an apartment for sleeping. The male gen-

erally occupies the outer room, while the female and the young are back in the part which is best protected from intruders. In most cases the litter consists of from four to six, brought forth in April. During the day the fox remains in hiding, but it comes out at night and moves about rapidly, often committing havoc among the poultry. The fox chase is looked upon as a favorite sport in England, where this animal is protected by law, except at a specified period, when it is pursued with dogs and horses which are trained especially for this purpose. The sport consists of seeing the cunning methods by which the animal seeks to avoid capture. It will often feign death and endure

HOME OF THE FOX.

rough treatment, seeking thereby to make good its escape.

FOX, the name of two rivers that rise in Wisconsin, though both are also known by other appellations. The Fox, or Pishtaka, has its source in Waukesha county, flows in a southerly direction and joins the Illinois River at Ottawa, Illinois. The Fox, or Neenah, rises in Green Lake county, makes a bold turn toward the west and north, after a tortuous course passes into Lake Winnebago, and thence flows northeast into Green Bay. Its entire course is about 250 miles. Near its headwater it approaches within two miles of the Wisconsin River, with which it is connected by a canal at Portage City, thus providing a union between Lake Michigan and the Mississippi River.

FOX, Charles James, noted statesman, born in London, England, Jan. 24, 1749; died Sept. 13, 1806. He was the second son of Henry, first Lord Holland, educated at Eton and Oxford, and elected to Parliament for Westminster at the age of nineteen. In his legislative policy he supported Lord North and became admiralty lord, and in 1782 obtained the office of Secretary of State for Foreign Affairs. In the rivalry between Burke and Pitt he sided with the former, and opposed the British coercive policy in dealing with the American colonies prior to and during the Revolution. His career as a statesman was distinguished by brilliant oratory and marked regard for the interest of colonial possessions. He ranked as a speaker with Burke, Sheridan, and Pitt. His remains were buried in Westminster Abbey.

FOX, George, founder of the society of Friends, born at Drayton, Leicestershire, England, in July, 1624; died Jan. 13, 1691. His religious work began at the age of nineteen, when he took the Bible for his creed and traveled throughout many portions of Britain, holding meetings and preaching the gospel. Besides opposing all superfluous religious ceremony, he refused to remove his hat for any one, and addressed both men and women by using the pronouns thee and thou. While the sincerity of his teaching was admitted, he was persecuted and placed under arrest at various times. In 1677 he accompanied Penn and Barclay to Germany and Holland, and also visited the American continent. From the trembling mode of delivery in preaching and the frequency with which he admonished the rulers to call upon the Lord in fear and trembling, his followers became known as *Quakers,* the term being first applied at Derby, England. He wrote numerous works relating to his doctrines.

FOX BAT, the general name of any large bat, or flying fox, which is characterized by its habit of eating fruit. Seventy species have been catalogued, all of which are native to Asia, Africa, and the Malay Archipelago. The species are mostly large and tailless. They have large eyes and pointed teeth, and have the color of the red fox. They do much dam-

age to mango and cocoanut plantations. In habit they are nocturnal, coming out at night in search of food. Their flesh is eaten by the natives.

FOXGLOVE, the common name of a genus of plants known as *Digitalis*, which includes a number of species that are native to Europe and Asia. The common foxgloves have erect stems with numerous large leaves at their bases. At the upper end of the stems are racemes of variously colored flowers. Several of the species have been greatly improved by cultivation and are grown as flowering plants in gardens and parks. They thrive best in light, rich soil. The drug known as *digitalis*, which is obtained from a species of foxglove, is a bitter substance and has sedative and narcotic properties.

FOXHOUND (fŏx'hound), one of several breeds of dogs which are of value in fox hunting. It is noted for its fleetness, perseverance, physical strength, and fine scent. Its average height is 21 inches. The foxhound is supposed to be a cross between the staghound and the bloodhound.

FOX INDIANS, a tribe of North American Indians belonging to the Algonquin family. Formerly it occupied portions of Iowa, Nebraska, and Kansas, but now only few remnants remain in these states and in Oklahoma. Many of these Indians are industrious and progressive, having acquired both educational advancement and financial stability. See **Sacs and Foxes.**

FOX SPARROW (spăr'rō), a handsome species of sparrow native to Canada and the United States. It has a rusty red plumage, but the breast is whitish. The eggs are thickly spotted and are laid in thickets or in tufts of grass. The song is loud and cheerful, resembling that of a thrush. It is migratory, passing far into the north of Canada to breed.

FOXTAIL GRASS, the name applied to several grasses with brush-like spikes which resemble the tail of a fox. Several species abound in meadows and pastures. They possess nutritive qualities, though some, from their hardy nature and remarkable tendency to multiply, are obnoxious weeds in cultivated lands. A number of species are naturalized in North America and are cultivated as forage plants.

FOX TERRIER (tĕr'rĭ-ĕr), a small dog which is useful in following the fox to its habitation. The weight is about eighteen pounds. Its spirit is keen and lively, and it is adapted in every way for companionship and service in the hunt.

FOYLE (foil), a river in Ireland, formed by the junction of the Finn and Mourne. It forms the boundary between Donegal and Londonderry counties and flows into Lough Foyle, an inlet on the northern coast of Ireland, four miles below the city of Londonderry. The entire length is about seventy miles. It is famous for its salmon fisheries.

FRACTION (frăk'shŭn), in algebra and arithmetic, an expression of one or more of the equal parts of a divided whole, or an expression for an unexecuted division, originally invented to represent a quantity less than a unit. The dividend number is called the *numerator*, because it numbers how many parts are taken, and the divisor is called the *denominator*, because it names the parts, thus, in the fraction ¾, 3 is the numerator and 4 is the denominator. A fraction is said to be *proper* when the denominator is greater than the numerator, and *improper*, when the numerator is greater than the denominator. In the former case the value is less and in the latter more than 1. If both terms of the fraction are equal, it represents 1, or unity. A decimal fraction is one whose denominator is 1 with zeros annexed, in which the denominator is not written, but is understood from a point being prefixed, with zeros if necessary; thus, .086 for $\frac{86}{1000}$. All the fundamental operations in arithmetic, that is, addition, subtraction, multiplication, and division, may be performed in fractions, but the denomination must be the same. In decimal fractions the denomination depends upon the position of the decimal point, as .1, .01, .001. Common fractions are reduced to a *common denominator* by multiplying both terms of each fraction by the denominator of the other fractions.

FRA DIAVOLO (frä dē-ä'vō-lō), celebrated brigand, born at Calabria, Italy, in 1760; executed in 1806. His name was Michele Pezza, but was changed to Fra Diavolo, signifying "brother devil." His training and education was that of a monk, but he became the leader of a band of robbers in the mountains of Calabria. In 1799 he joined the forces of Ferdinand of Naples against France and was raised to the rank of a colonel. Later he tried to organize an insurrection in Calabria, but was captured and hanged as a robber. Auber's "Fra Diavolo" is based upon the experiences of Michele Pezza.

FRAMINGHAM (frā'mĭng-hăm), a town of Massachusetts, in Middlesex County, on the Sudbury River, twenty miles west of Boston. It is on the Boston and Albany and the New York, New Haven and Hartford railroads. Among the chief buildings are a State normal school, a hospital, a public library, and a home for the aged. The manufactures include chairs, woolen cloth, rubber goods, and boots and shoes. The first settlement, made about 1647, was known as Danforth's Plantation. It was incorporated in 1700. Population, 1925, 21,078.

FRANC (frăṅk), a silver coin of France, divided into ten decimes and 100 centimes. It was first coined in 1795 and was adopted by Belgium in 1833 and by Switzerland in 1849. It corresponds in coinage to the cent of Canada

and the United States, in that it is issued in different denominations, such as 1, 2, and 5 franc pieces. The value of a franc is about 9½ pence in English money and a little over 19 cents in the money of Canada and the United States.

FRANCE (frâns), a republic of Western Europe, located between latitude 42° 20′ and 51° 5′ north and longitude 4° 48′ west and 7° 31′ east from Greenwich. It is bounded on the north by the English Channel, the Strait of Dover, and the North Sea; east by Belgium, Germany, Switzerland, and Italy; south by the Mediterranean Sea and Spain; and west by the Atlantic Ocean and the English Channel. Its greatest breadth from east to west is 552 miles, and its length from north to south is 605 miles. In size it ranks fourth among the countries of Europe. The numerous coast indentations afford many good harbors, thus rendering the country capable of supporting an extensive maritime system. Numerous islands abound off the northwestern shore, the largest of which are Ré, Belle Isle, and Oléron. The total area is 212,710 square miles. This includes Corsica and a number of small islands, which have a surface of 3,700 square miles.

Description. The eastern portion of France is traversed by numerous mountain chains, of which the Pyrenees, Cévennes, and Vosges are the most prominent. These mountain ranges form the principal watershed, the rivers flowing from them to the west and north toward the Atlantic, and on the opposite side to the south and east into the Mediterranean. Vignemale, the highest peak of the Pyrenees in France, has an altitude of 10,792 feet. Mont Blanc, height 15,781 feet, is the culminating peak of the Alps, and is on the line between France and Italy, near Switzerland. The interior of France is marked by several volcanic groups known by the general name of Auvergne, while the coast region along the English Channel is largely level and exceedingly fertile. The Pyrenees separate France from Spain and have a general altitude of 9,000 feet. Passes for railroads are located at both ends of the range, near the coasts, but few highways cross these mountains. The Alps separate France from Switzerland and Italy, with celebrated passes and railway tunnels in the vicinity of Mont Cenis. The Jura Mountains are between France and Switzerland, and the Vosges extend from the western border into Germany. Corsica, where Monte Cinto has an elevation of 8,900 feet, belongs physically to Italy rather than France, and is united with it by a submarine plateau.

Many important river basins are formed by the foothills and mountains, through which flow numerous navigable streams. The entire number capable of navigation is about 200, and the total length of interior navigation aggregates 6,000 miles. Among the larger streams are the Rhone, the Loire, the Garonne, and the Seine. The largest of these is the Rhone, which passes from Switzerland through a gap between the Jura and the Alps into France, receives the Saône, another tributary, and flows southward into the Mediterranean by a delta. The Garonne rises in Spain, flows through a mountainous section in the upper course, and discharges into the Atlantic through the estuary of the Gironde. The Loire and Seine likewise discharge into the Atlantic. Other streams include the Isère, Durance, Dordogne, Mayenne, Eúre, Charente, and Sarthe. Lake Geneva is the most important inland water, but a portion of it lies in Switzerland. Bourget and Annecy are other lakes of the Rhone Basin, and aside from those mentioned there is none of considerable size. A number of lagoons are located along the coast.

Climate. As a whole the climate is favorable and among the most healthful in Europe. The isothermal lines of France indicate a normal temperature of about 50°. The regions in the southeast are the warmest and those in the northwest are the coldest, though all portions, except the most elevated mountain ranges, are susceptible to profitable cultivation, and are marked by atmospheric brightness and salubrity. At Paris the temperature averages 36° in January and 65° in July. The rainfall averages about thirty inches for the whole country, ranging from ten inches in the elevated northern plains to forty inches along the sea coast and in the Cévennes.

Flora and Fauna. France has a flora quite like that of the other countries in continental Europe, except in the more recently formed summits, where lichens and mosses abound. Forests of ash, oak, pine, and spruce characterize the regions of medium elevation, and the chestnut and mulberry are common to the less elevated sections in the south of France. Nutritious grasses are very common. Wild animal life is not abundant, owing to the country having been settled a long period of time. The chamois is found in the mountains, the mouflon is met in Corsica, and the fallow deer and wild boar are preserved in private estates and reservations. Many birds of song and plumage are common, and water fowls are numerous along the coasts. The fisheries yield many valuable catches, including oysters.

Mining. Valenciennes, in the northeastern part, is the center of productive coal fields, which are estimated at about 2,250 square miles. The deposits consist chiefly of a good grade of bituminous coal, valuable in manufacturing, but anthracite is found in the department of Isère and lignite coal occurs in the Pyrenees. Iron ore is obtained in considerable quantities, especially in the Jurassic rocks and in the Pyrenees, but the output is not adequate to the demand. Some copper is obtained near Lyons. Other metals include zinc, nickel, sil-

ver, lead, and antimony. France is rich in building material and quarry products. Granite, limestone, and sandstone are abundant, and a fine grade of marble is quarried in the Alps and the Pyrenees. Roofing slate is quarried in the Ardennes and phosphate rock occurs in several localities. The latter is used in the manufacture of fertilizers.

Agriculture. France is distinctly an agricultural country, being favored by a mild climate and general fertility of the soil. The methods employed by the peasants are modern and tillage is conducted with great care. About 6,750,000 people are employed in agricultural pursuits and fifty-eight per cent. of the land is under cultivation. Wheat, rye, barley, and oats are the staple cereals. In the production of wheat France exceeds all countries of Europe, except Russia. Beets are grown extensively for the manufacture of sugar. The government has a monopoly in the cultivation of tobacco. Other products include flax, maize, potatoes, rape, hemp, and buckwheat. Vegetables are produced in all sections, while fruits abound extensively, though they are grown most successfully in the southern portion, where the peach, pear, orange, lemon, fig, and citron thrive. The adaptable condition of the soil for the production of forage crop has caused France to rank as a leading country in the rearing of cattle, horses, sheep, and goats. However, it is necessary to import meat, but eggs, honey, and dairy products are exported. Dairying is an important industry and in many sections is associated more or less with the rearing of swine. The culture of silkworms receives marked attention in the warm portions, where it is fostered on a large scale. The vineyards are especially prolific and about one twenty-fifth of the whole surface is planted to vines.

Commerce. France has fostered a policy of tariff protection, especially during the period following the War of 1870-71, but more liberal rates have prevailed since 1882. Raw cotton, wool, raw silk, timber, cereals, and coal and coke are the chief imports, while the exports include leather, cotton and silk textiles, metal goods, chemical products, wine, and clothing. The nations that have the largest share of foreign trade are Great Britain, Belgium, Germany, Switzerland, and the United States in the order named. The foreign trade has an annual value of $4,250,000,000 and the exports slightly exceed the imports. Foreign trade is promoted by an efficient merchant marine, which consists of about 1,500 steamers and 15,000 sailing vessels, including many of small size.

Manufactures. France ranks as the fourth manufacturing country, being exceeded only by Great Britain, Germany, and the United States. In the output of textile fabrics, especially silk goods, it has long held a prominent place. The textile fabrics center largely at Lyons, Rouen, and Paris. Cotton and woolen goods are made in large quantities at Rheims and Amiens; lace and gauze, at Saint Quentin; tapestry at Paris and Beauvais; and carpets, at Abbeville. Large quantities of safes, files, hardware, jewelry, and optical instruments are manufactured for exportation. In the manufacture of wine France has held a foremost position many centuries, and its cognac is still the leading product of the kind in the world. It likewise has taken a foremost position in the manufactures of engines, motors, and automobiles. Fruit canning is carried on extensively and the fisheries yield many products employed in manufacturing. Special mention may be made of the tunny, anchovy, oyster, mackerel, and sardines, all of which are cured and canned.

Transportation. Extensive railroad and canal facilities make it possible to carry on a vast interior commerce, and to bring the products for shipment to the principal seaports. The railways are largely under direct government supervision and in efficiency take a peculiarly high rank. They aggregate a total of 31,750 miles, hence Germany and Russia are the only European countries that have a larger mileage. Paris is the converging center of all the railway systems of France, with the exception of one line. The canals aggregate 2,975 miles and the navigable streams have a length of 5,500 miles. In addition there are many electric railways throughout the more populous sections of the country, and the highways are generally in a good condition. The canals connect the various river basins and facilitate transportation to the Atlantic Ocean, the North Sea, and the Mediterranean. Among the most important of the canals are the canal of Languedoc, which connects the Garonne with the Mediterranean; the Rhone and Rhine canal; and the canal of Bourgogne. Telegraph and telephone lines are everywhere manifest and efficiently managed, and, like the canals and railroads, are largely under direct government supervision and ownership.

Government. The government of France is a constitutional republic, in which three departments of government are recognized, and dates from Sept. 4, 1870, when the second empire was overthrown as a direct result of the Franco-German War. Its legislative authority is vested in two chambers, the Chamber of Deputies and the Senate. Representation in the former is elective and in the latter it is appointive by officials of the departments. In the Chamber of Deputies are 584 members, chosen for four years, and the Senate is composed of 300 members, elected for nine years, one-third retiring every three years. The entire country is divided into 87 departments. Each of these is divided for election purposes into *arrondissements*, and these are subdivided into smaller divisions for the purpose of local government. The system of justice, like that of Canada and the United States, originates in inferior courts,

and, after passing through courts of appeals, terminates in the supreme court of the state, which has its seat at the capital. Cases of attempt against the safety of the state or of plotting to change the form of government are tried by the Senate, which is then constituted as a high court of justice. The president is elected for a term of seven years by the two chambers, a majority of both bodies being necessary to a choice. He has the appointment of civil and military posts, and is assisted by twelve ministers whom he appoints. The ministry consists of ministers of the interior, finance, war, justice and public worship, marine, colonies, public instruction, foreign affairs, commerce, agriculture, public works, and labor.

Education. Educationally France occupies a high position among the countries of Southwestern Europe. The minister of public instruction, who is appointed by the president and is a member of the cabinet, has supervision of all the branches of education and is assisted by an educational council. Primary, secondary, and high schools are maintained under appropriate courses of study, and they are supplemented by colleges and universities devoted to industrial art, law, theology, literature, and medicine. All the communes are required to have primary schools, but, where the population exceeds 500, the schools for boys and girls are separate. In the capital of each department and some other cities are institutions of higher learning, the whole number being about 275. In 1918 the secondary schools were attended by 127,642 and the universities by 34,368 students.

Defense. Military service is obligatory on every Frenchman from the age of 20 to 45 years, who is not declared unfit for military duty. The present peace footing is 575,000 men and officers, though the entire war strength, including the colonies, aggregates 3,500,000 men. France occupies a high position in the naval administration, which is divided into three marine divisions. The number of men and officers in the navy is placed at 54,350. It has 44 battleships completed or in the course of construction and a proportionately large number of protected cruisers, torpedo boats, and torpedo boat destroyers. The principal sources of revenue are land taxes, registration, customs and excises, railroads and telegraphs, and licenses. The total national debt is large, being about $22,800,000,000, and the revenue and expenditures are correspondingly large, due in part to war activities.

Inhabitants. More than a million of the inhabitants of France proper are foreigners, mostly of European birth, while the rate of increase in population is very small, but there is a small preponderance of births over deaths. However, the increase of the last several decades may be attributed to immigration. The three chief religious denominations are Roman Catholic, Lutheran, and Jewish in the order named. Religious worship has been free since the adoption of the Organic Articles in 1802, but the three churches named were subsidized by the state until 1905, when the law which separates the church and the state came into force. About two-thirds of the people are nominally Roman Catholics. Fifteen cities have a population of more than 100,000. Paris, the capital and largest city, is one of the most important centers of population in the world. The other cities of importance include Lyons, Marseilles, Bordeaux, Lille, Toulouse, Nantes, Saint Etienne, Havre, Rheims, Roubaix, Rouen, Rennes. The population of France, exclusive of the colonies, in 1921, was 39,801,509.

Colonies. The colonial possessions of France have an area of 4,055,150 square miles and a population estimated at 56,675,000. They are variously distributed in Asia, Africa, America, and Oceania, and have been the means of greatly increasing foreign trade and influence. The larger part of these possessions is African and the colonies of Oceania are not particularly valuable. The latter include New Caledonia and a number of dependencies.

The French colonies of America are Guiana, Guadeloupe, Martinique, Saint Pierre, and Miquelon, and those of Asia include Indo-China, Annam, Cambodia, Cochin-China, Tonkin, and Laos. The African possessions embrace Algeria, French Congo, French Guinea, Comoro Isles, Dahomey, Ivory Coast, Mayotto, Madagascar, Somali Coast, Réunion, Senegal, Niger, Senegambia, Tunis, and Western Sahara.

Language. Before the Romans occupied Gaul, Celtic was the chief dialect spoken in the region now occupied by France, and that language is still spoken in Brittany. The French language is classed with the Romanic group, of which it is the most important dialect, the other languages of this group being the Spanish, Italian, Portuguese, Provençal, and the Wallachian or Romanic. After Roman occupation the Gallic, Celtic, and other local dialects gradually became modified by the introduction of new elements, and by the 8th century a marked distinction existed between the popular language of France and the classic Latin. They were distinguished by the names *Romana* and *Latina,* and, when the new Romance tongue became generally adopted, it was named *French.* Louis the German in 842 took an oath in the Romance tongue in Strasburg, and this is regarded the oldest written document in that dialect extant. Francis I. prohibited the use of Latin at court in the beginning of the 16th century, since which time French has been recognized as the national language. French is spoken generally throughout the country, but Flemish and German are used locally on the border of Belgium and Germany, and Italian is spoken in the southeastern part. It has been the language of diplomacy, cookery, fine art, and the European aristocracy since the Middle French

period. Its greatest popularity was attained in the reign of Napoleon, though it is now the language of about 50,000,000 people, and its literature is exceptionally rich.

Literature. The literature of France is both extensive and valuable, embracing many products of a large number of eminent writers. It may be said to begin with the 11th century, when numerous poems were collected and published. These poems embrace at least three classes, including those that relate to the achievements of Charlemagne and his descendants; those relating to ancient history, particularly Alexander the Great; and those detailing the life and achievements of King Arthur. Philippe de Comines (1445-1509) is one of the first historians of eminence, dealing with the life and times of Louis XI. and his contemporaries, but the writings of Froissart (1337-1410), which include a collection of poems and tales of the chivalry of the 14th century, are perhaps the most popular productions of the early period. French literature was greatly modified by the revival of classical learning, when public thought was directed to classical study and sacred history. The humorist Rabelais (1490-1553) belongs to the same period, as also does the essayist Montaigne (1533-1592). In that period the great theological work of John Calvin, entitled "Institution of the Christian Religion," exercised a wide influence upon the public thought of France, and was the cause of inducing many writers to turn with renewed vigor to works in prose. Clément Marot (1495-1544) wrote numerous witty poetic productions, while Margaret of Navarre issued popular tales, and Jodelle (1532-1573) gave an impetus to tragedy.

With the advent of Louis XIV. came the golden age of French literature. At that time Pierre Corneille (1606-1684) wrote his masterpieces, entitled "Horace," "Cid," "Cinna," and "Polyeucte;" Pascal (1623-1662) created interest by his "Provençal Letters;" and Racine (1639-1699) wrote his "Iphigenie Phedre," "Athalie," and other noted comedies for the stage. Fine works in prose were added to the general writings by Jean Louis Balzac (1594-1654) and Voiture (1598-1648), while Descartes produced works of high philosophical value. Molière wrote his familiar plays, "School of Women," "Misanthrope," and "Tartufe," and elegant sermons were added to French literature by Massillon, Bossuet, and Bourdaloue. Other writers of the 17th century include the historians, Cardinal de Retz and Madame de Sévigné; the biographical writers, Saint Evremond and La Rochefoucauld; and the miscellaneous writers, Le Sage and Bernard Fontenelle (1657-1757).

Many works of philosophical value were added to the literature in the 18th century, but that period likewise produced much of value in other essential lines. Voltaire not only wrote valuable works in philosophy, but also holds a high place as a historian, dramatist, and poet, and for more than half a century stood at the head of French letters. The satirist, Montesquieu, is the author of "Persian Letters" and of many historical and general works, including "Spirit of the Laws." As a writer of elegant style and profound thought Rousseau stands next to Voltaire, his chief works being "Nouvelle Heloise" and "Confessions," while his "Social Contract" and "Emile" continue to exercise a wide influence in education and politics. The "Encyclopaedie," an extensive review of general subjects, though quite hostile to religion, was published by Diderot and D'Alembert. Other works of importance include Prevost's "Manon Lescaut," Saint Pierre's "Paul and Virginia," Beaumarchais' "Barber of Seville," and Buffon's "Natural History." Helvetius, Lamettrie, Condorcet, and Condillac may be mentioned as other writers of note.

The 19th century produced a large number of writers, owing largely to the brilliant achievements of Napoleon and the general establishment of schools and institutions of higher learning. In that period rose the so-called Romantic School, of which Victor Hugo, Alfred de Vigny, and Alexandre Dumas are leading representatives. "Les Miserables" is the masterpiece of Hugo, while "Cinq-Mars" is the best novel from the pen of De Vigny, and "Three Guardsmen" and "Count of Monte Cristo" are popular works by Dumas. Among the novelists of eminence are Honoré de Balzac, who belongs to the so-called Realistic School, George Sand, Eugène Sue, Gustave Flaubert, Victorien Sardou, and Octave Feuillet. Jules Simon, Bastiat, and De Tocqueville rank among the eminent writers on political economy; Guizot, Thiers, Victor Duruy, and Henri Martin among the historians; Victor Cousin, Auguste Comte, and Lamennais among the philosophical writers, and Cuvier and Saint-Hilaire among the scientific writers. Stanislas Julien and Burnouf added much of value to Oriental knowledge; Leconte de Lisle, Gautier, and Theodore Aubanel to poetry, and among the essayists and literary critics are Gustave Planché, Théophile Gautier, and Paul de Saint-Victor.

The beginning of the 20th century witnessed unusual activity in French literature. It is evident that the century will be unusually prolific and that the productions will excel in number and value those of the previous period. Among the eminent historians are Ernest Lavisse and M. Rambaud; among the poets, Henri de Régnier and Paul Verlaine; among the critics, Charles Bernard Renouvier and Edgar Quinet; and among the general writers, Émile Zola, Marcel Monnier, Alphonse Daudet, Émile Faguet (born in 1847), and Frederick Masson. For several years at the beginning of the century much was written upon social and political events, owing to the long discussion of the

Dreyfus affair. Such writers as Émile Zola and Anatole France wrote much on the side of Dreyfus, while Bourget, Barrès, and Brunetière took a position in opposition to the influences created by the affair. The period has been especially prolific in the field of fiction and the drama.

History. Julius Caesar, who wrote regarding his invasion and conquest in 59 B. C., furnishes the first authentic history of France. The Roman name was Gallia, while the early English was Gaul, and the people were largely Celtic in race, though other settlements were maintained, especially by the Aquitani and Belgae, with here and there tribes of Germans and Greeks. At that early period it contained parts of Switzerland, Germany, and Belgium, as well as the whole of France. The name France was derived from the Franks, a Germanic tribe that made settlements in Gaul after the decline of the Roman Empire. By the 2d century A. D. it was Romanized in civilization, language, and religion. Under the Roman rule it advanced materially in civilization and refinement and the population increased rapidly. Gradually agriculture and manufacture took the place of the simpler arts of the semisavage people.

The Franks by the end of the 5th century made themselves masters of nearly all of France and conquered adjacent territory east of the Rhine. In 481 Clovis, a descendant of Merovig, established the first dynasty, called the Merovingian, with his capital at Paris, and reigned until his death in 511, when his kingdom became divided among his four sons. The country was subsequently divided among other rulers under a general law of inheritance, by which numerous principalities rose. The last of the first dynasty terminated in 752, when the Carlovingian arose, its greatest representative being Charlemagne, who was the second ruler. At that time there was no real kingdom of France, for the reason that the first dynasty was Germanic, and Charlemagne founded a German rather than a French empire.

The true founder of the French monarchy was Hugh Capet, who established the Capetian dynasty in 987, and added the fiefs of Orleans and Paris to the monarchy. For two centuries the Capetian dynasty endeavored to reconquer former prerogatives from vassals, and strained its powers in resisting English pretensions to the crown of France. The first branch of Capetian kings became extinct with the death of Charles IV., in 1328, for the reason that the Salic law excluded female succession. At that time the crown passed to Philip of Valois, who ascended the throne as Philip VI., which led to a series of wars with England on account of the claims made by Edward III. to the throne, and these continued for 125 years. The most important battles occurred at Crécy in 1346, Poitiers in 1356, and Agincourt in 1415. All of these resulted more or less favorably to England and gave that country many of the best provinces, while the Treaty of Troyes, drawn shortly after the Battle of Agincourt, recognized the succession of Edward III. to the crown of France. The animation of the French, due to the noble deeds of Joan of Arc between 1429 and 1431, caused a complete change and drove the English from the country, the only possession remaining to them being Calais.

Louis IV. laid the foundation of a great monarchy in 1461, largely restored internal peace, and brought back a feeling of nationalism. The Valois-Orleans branch of the Valois line succeeded to the throne in 1498, but in 1515 the crown reverted to another branch of the house of Valois in the person of Francis I. This sovereign carried forward the attempts to conquer Italy begun by previous monarchs, and became involved in five great wars with Germany, which terminated in the loss of some prestige and the transfer of Savoy and Piedmont by the Treaty of Cateau-Cambresis, though this loss was at least partly balanced by securing Calais, the last possession of the English in France. Francis II. reigned only in 1559-60, but during this brief time the Catholic house of Guise attained power, while the opposing movements for the reforms were led by the house of Bourbon. The religious wars of this epoch shed much blood and retarded the industrial growth of France. Within this period occurred the massacre of Saint Bartholomew, and the great national debt which weighed upon France more than two centuries was fastened upon the country. The religious wars terminated only when Henry IV., previously King of Navarre, went over to the Catholic Church from the leadership of the Huguenots.

Louis XIII. succeeded to the throne in 1610 and inaugurated a new policy by siding with Richelieu, a Protestant prince, in a reformation. At his death in 1643, Louis XIV. began a memorable reign, which was marked by a still more vigorous policy and led to the highest power and widest influence attained by the French monarchy. Under his wise direction French literature, art, and science developed to a higher plane than before known, education flourished, and the borders of France were extended to the Rhine. The efficient service of the military engineer, Sébastien Vauban (1633-1707), strengthened French fortifications, while its ministers secured advantageous commercial treaties. Louis XV. added Corsica and Lorraine to France by the Treaty of Paris. However, in 1763 French colonies were largely ceded to England on account of misfortunes in war.

The weakness of Louis XVI., the success of the American Revolution, and the great spirit of unrest that marked the closing of the 18th century led to the revolution of 1789. War raged with all its horrors and cast an unfortunate people into a great sea of bloodshed, which

finally led to the execution of Louis XVI., in January, 1793. This was followed by a treaty of peace and the general amnesty of 1795. The French Republic was recognized by the Treaty of Basel in the same year, while a new constitution was formulated by the convention, which finally dissolved in October. The scheme of government provided a chamber of 500 to propose laws, the chamber of ancients to approve them, and the executive of five members called the Directory. Napoleon Bonaparte soon became the most prominent man in France. His successes led to the overthrow of the Directory and the establishment of the Consulate, himself being appointed first consul for a term of ten years. The brilliant victory won on the battlefield of Marengo and the extension of France to the Rhine led to the proclamation in 1804, by which he became emperor, and was soon after confirmed by a popular vote of the people. Pope Pius VII. consecrated Napoleon emperor at Paris, and crowned him King of Italy in 1805.

Though an extensive coalition was formed against Napoleon by European powers, they were unable to check his career and France became the greatest power of Europe. The great Battle of Austerlitz in 1805 caused the King of Naples to be dethroned, Holland became a vassal kingdom, and Prussia was humiliated. At that time the kingdom set up by Napoleon extended from Naples to Denmark and the capitals were Amsterdam, Paris, and Rome. The Russian invasion of 1812 cost France 300,000 men, but the allied forces were defeated in the Battle of Leipzig in 1813. In 1814 the allied armies drove the French from Germany and captured Paris, on March 30. Napoleon was required to abdicate and retired to Elba as a mere prince. Louis XVIII. became King of France and concluded the Peace of Paris, but was soon driven from power by the return of Napoleon, who assumed authority without resistance. The allied powers reorganized, brought on his final defeat at Waterloo in 1815, and sent him a prisoner to Saint Helena.

The long line of French kings ended with Louis Philippe, who was driven into exile by the revolution of 1848, and a republic was proclaimed with Louis Napoleon as the president. By a vote of the people he was made emperor in 1851, with the title of Napoleon III. The growing discontent of the people caused him to declare war against Germany in 1870, which resulted in a disastrous loss to the French army upon every battlefield, and the empire ended with the capture of Napoleon and 83,000 men at Sedan. As a war indemnity France was required to cede Alsace and a part of Lorraine to Germany and pay $1,000,000,000 in gold. Civil war broke out in Paris under the leadership of the Commune, which was put down with difficulty.

The second republic having been organized, M. Thiers was chosen the first president. With the overthrow of the administration in 1873 came the election of Marshal MacMahon, who resigned the presidency in 1879, and was succeeded by Jules Grévy. The last mentioned was followed in the presidency by Sadi Carnot in 1887. After the assassination of Carnot in 1894, Jean Casimir-Périer succeeded to the presidency, and, when the latter resigned in 1895, Felix Faure attained the election. President Faure died on Feb. 16, 1899, and was succeeded by M. Loubet. Subsequently the following were elected presidents: Clément Armand Falléries, 1906; Raymond Poincaré, 1913; Paul Deschanel, 1920 (died 1922); Alexandre Millerand, 1922 (resigned 1924); and Gaston Doumergue, 1924.

France became involved in the Great European War at its beginning, in 1914, and promptly invaded Alsace-Lorraine, while the German armies moved forward in great waves through Belgium and penetrated into France as far as the Marne River, where they were halted by strong opposition and compelled to retreat. Throughout the war France was the scene of heavy fighting, the curved battle line extending from Switzerland to the North Sea, a distance of 250 miles. The fortunes of war swung back and forth about four years, until the autumn of 1918, when the German forces were outnumbered and compelled to fall back before the advancing armies of the allied nations. France bore a conspicuous part in this war, the greatest ever to occur, and was given much consideration at the Paris Peace Congress. Besides strengthening its political and commercial activities, it received Alsace-Lorraine and a considerable portion of the damage which Germany was compelled to pay. See **War.**

FRANCE (fräns), **Anatole,** poet and novelist, born in Paris, France, April 16, 1844. His real name was Jacques Anatole Thibault, but he is generally known by his literary name of Anatole France. He studied at Stanislas College, Paris, and became attached to the work of a librarian. His works include "The Red Lily," "The Garden of Epicurus," and "Opinions of Jerome Coignard." He died Oct. 13, 1924.

FRANCHISE (frăn'chĭz), a special privilege granted by government to individuals or corporations, and which do not belong to the citizens of the state or country by common right. In a political sense the term franchise denotes the right of suffrage and is commonly called the *elective franchise.* However, it is generally applied to special privileges granted for the purpose of constructing improvements for profit, such as the establishment and operation of toll bridges and ferries. Towns and cities grant franchises to gas, water, heating, and electric light companies.

FRANCIA (frän'chà), **Francesco,** painter and engraver, born in Bologna, Italy, in 1450; died in 1518. His real name was Francesco di

Marco Raibolini. He was the son of a carpenter and worked at the trade of a goldsmith until 1490, but in the meantime gave much attention to painting and engraving. Later in life he took up a line of fresco painting, the most notable example in the series being illustrations from the life of Saint Cecilia. He painted some fine work for the Bentivoglio Chapel, including an altarpiece with exceptionally fine portraits. Among his well-known works are paintings of the "Madonna Enthroned," at Bologna; "Saint Stephen, in the Borghese Palace at Rome; "Madonna," in the Museum of Berlin; and "Virgin in a Rose Garden Adoring the Christchild," in the Munich Gallery.

FRANCIS I. (frăn'sĭs), King of France, born in Cognac, France, Sept. 12, 1494; died March 31, 1547. He was a student of science and chivalric literature, married the daughter of Louis XII., and succeeded him as king on Jan. 1, 1515. Shortly after ascending the throne, he sent a force against Milan with the intention of annexing it to his dominion. His advance was opposed by the allied armies of Henry VIII. and Charles V., who had formed an alliance with the Pope. They expelled his forces from Italy and shortly after invaded northern France. In 1525 he was taken prisoner at the Battle of Pavia and was kept in confinement at Madrid for a year, but was given his freedom on the expressed condition of surrendering all claims to his Italian possessions, Artois, Flanders, and the duchy of Burgundy. Since Charles V. of Spain was a rival candidate for the imperial crown of Germany, the war between him and Francis I. continued, but it was finally terminated in 1544 by the Treaty of Crespy. Within his reign the revival of learning greatly influenced France, the Protestant Reformation had its beginning, and the power of the monarchy was strengthened. Learning and art rose under his policy of inviting scholars and painters to the cities. He fostered the building of highways, palaces, libraries, and institutions of higher education. His character was marked by a gay and amiable disposition, heroic impulses, and acts of liberality. However, his policy of persecution actively conducted against the Vaudois placed him in an unenviable light.

FRANCIS II., King of France, eldest son of Henry II. and of Catherine de Medici, born in Fontainebleau, Jan. 19, 1543; died Dec. 5, 1560. He married Mary Stuart, daughter of James V. of Scotland, afterward Queen of Scotland, in 1558, and ascended the throne of France on July 10, 1559. He was then a sickly boy of about sixteen years. The government was under the influence of the Duke of Guise and the country was disturbed by civil contentions during his brief reign.

FRANCIS I., Holy Roman Emperor, born Dec. 8, 1708; died at Innsbruck, Aug. 18, 1765. He was the son of Leopold, Duke of Lorraine, married Maria Theresa, daughter of Charles VI., in 1737, and was crowned emperor on Oct. 4, 1745, as successor to Charles VII. His administration was disturbed by a long war against Frederick the Great, known as the Seven Years' War, in which Austria and Prussia contended for supremacy. He was succeeded in Germany by his son, Joseph II., under the regency of his mother, and in Tuscany by his younger son, who afterward became Leopold II.

FRANCIS II., Holy Roman Emperor and Francis I., Emperor of Austria, eldest son of Leopold II., grand duke of Tuscany, born in Florence, Italy, Feb. 12, 1768; died March 2, 1835. His father became Emperor of Austria in 1790 by the death of his brother, Joseph, and two years later the crown devolved upon Francis. The French revolution was fast organizing and exciting alarm among the dynasties of Europe, which induced Francis to conclude an alliance with Prussia against the new republic, and, after a series of hostilities, the Peace of Campo Formio was concluded in 1797. He formed a new alliance with Russia and England in 1799 with a view of humbling the pride of France. At first the allies were successful in Italy, Germany, and Switzerland, but, after the return of Napoleon from Africa, Austrian power was paralyzed by the French victories at Hohenlinden and Marengo. These successes were followed by Francis ceding the left bank of the Rhine to France. When France was declared an empire in 1804, Francis assumed the title of hereditary Emperor of Austria.

In 1805, hostilities were renewed between Austria and France, but the great Battle of Austerlitz terminated in the Peace of Presburg, by which Francis surrendered Tyrol and the Venetian states. By this treaty the Holy Roman Empire, which had prevailed about 1,000 years, was dissolved, and Francis assumed the title of Emperor of Austria and King of Bohemia and Hungary. In 1809 Francis again became a leader in the war against France and secured a victory at Aspern, but Napoleon soon after occupied Vienna and dictated terms of peace, the chief condition of which required Francis to surrender 42,000 square miles of territory. History accords him a place among the extreme absolutists in politics, an advocate of the centralization of administrative powers. He labored indefatigably for the welfare of the people, encouraged education, built canals and highways, introduced manufactures, and sought to solidify the German states. However, his designs were frustrated by the extreme unrest and excitement of the Napoleonic wars.

FRANCIS, David Rowland, public man, born in Richmond, Ky., October 1, 1850; died at Saint Louis, Mo., July 2, 1927. He studied at the Washington University in Saint Louis, from which he graduated in 1870. He first engaged as shipping clerk, then was in the grain commission business, and in 1884 was elected president of the Merchant's Exchange.

In 1884 he attended the Democratic national convention in Chicago as a supporter of Cleveland, and in 1885 was elected mayor of Saint Louis. His successful administration brought about his election for Governor of Missouri in 1888, and after the expiration of his term of office he retired from active politics, but accepted the position of Secretary of the Interior in Cleveland's Cabinet in 1896. He was president of the Louisiana Purchase Exposition in 1904, and in that office gave evidence of much ability as a man of affairs. Subsequently he traveled extensively and visited many of the leading countries of the world.

FRANCIS, Saint, noted saint of the Roman Catholic Church, known as Francis of Assisi, founder of the order of Franciscans, born in Assisi in 1182; died Oct. 4, 1226. His early youth was marked by a disposition of innocent gaiety. He secured a liberal training and devoted his life to religious culture. In 1209 he founded the order of Franciscans, though he had but two followers, and devised rules for the guidance and instruction for those whom he taught. Its teachings require the members to devote themselves strictly to a compliance with the injunction to preach the gospel to all people, to do the greatest possible good, and to let each day care for itself. Pope Innocent III. approved the order in 1210, and two years later the church Sta. Maria degli Angeli was set apart for the occupation of its members. The effects of his work extended so rapidly that it was possible to hold a general assembly with 5,000 members in 1219, at which a better understanding and greater inspiration were obtained. The Sultan of Turkey granted the Franciscans the guardianship of the Church of the Holy Sepulcher in Palestine, which is still in their charge.

FRANCIS FERDINAND, archduke of Austria-Hungary, born Dec. 18, 1863; assassinated June 28, 1914.. His father, Archduke Carl Ludwig, was a brother of Francis Joseph. In 1889 he became heir-apparent, at the death of Prince Rudolph, only son of Francis Joseph, and the following year married Sophie of Hohenberg. The royal couple was murdered in Servia, while visiting Sarajevo, the capital. This circumstance was the direct cause of the Great European War, which began July 28, 1914. See **Charles I.**

FRANCIS JOSEPH I., Emperor of Austria and King of Hungary, nephew of Emperor Ferdinand I., born Aug. 18, 1830. He became Emperor of Austria on Dec. 2, 1848, and King of Hungary on June 8, 1867. He was educated in the best schools of Austria and learned to speak the various languages and dialects spoken in the Austro-Hungarian dominion. In 1854 he married Princess Elizabeth (q. v.), daughter of Duke Maximilian Joseph. A constitutional monarchy was promised before ascending the throne, but he assumed absolute power by dissolving the national assembly, which resulted in a rebellion led by Hungary. These disturbances were put down with the assistance of Russia. National ties were strengthened by measures designed to extend educational arts, reform the civil service, and enlarge internal improvements. At the time of the Crimean War he remained neutral, and in 1855 signed a concordat with the Pope by which the clergy secured large influence over educational affairs.

FRANCIS JOSEPH I.

In 1859, at the beginning of the war between France and Italy, he took the field in person. His forces were defeated at Magenta and Solferino, which resulted in the loss of Lombardy. In 1864 he formed an alliance with Prussia to annex Schleswig-Holstein, which resulted in a dispute over the division, and led to the war of 1866 between Austria and the allied forces of Prussia and Italy. This war, known as the Seven Weeks' War, ended with the defeat of the Austrians at Sadowa, and caused Austria to be excluded from the North German Confederation. Francis assumed a conciliatory policy in 1865. Soon after a constitution was granted, Hungary became reconciled, and the crown of the King of Hungary was accorded to him. Since then Austria has been prosperous, a result following the reform of its civil laws. The concordat was suspended in 1870, when the educational affairs were placed under the direction of the national government, higher institutions of learning multiplied, and internal improvements were fostered. In 1908 he issued a proclamation by which Bosnia and Herzegovina were formally annexed to Austria-Hungary. He died Nov. 1, 1916, at the age of 86 years, and was succeeded by Charles I.

FRANCIS MOUNTAINS, a group of the White Mountains, in New Hampshire, from which they are separated by the White Mountain Notch. Mount Lafayette, height 5,295 feet, is the highest peak. Many beautiful lakes, steep precipices, and natural forests give the region a grand and beautiful aspect.

FRANCIS XAVIER. See **Xavier.**

FRANCKE (fräṉ'kę), **August Hermann,** teacher and theologian, born in Lübeck, Germany, March 23, 1663; died June 8, 1727. He graduated at Leipzig in 1685 and began to deliver biblical lectures there while a student. Later he secured an appointment at Lüneburg and afterward at Dresden, and in 1689 returned to Leipzig as a lecturer on topics relat-

ing to the Scriptures. In 1695 he was called to Halle, where he accepted the professorship in Oriental languages. About the same time he secured an appointment as minister for the suburb Glaucha, where the neglected condition of the children attracted his attention and caused him to organize a school to promote their elementary training. In 1698 he founded an orphan asylum, and a few years later established a pedagogium and Latin school with dormitories attached. This establishment grew rapidly in public favor and in 1714 was attended by 920 girls and 1,080 boys, who received instruction from 178 teachers under the superintendence of Francke. Nearly all the instructors were students at the University of Halle and received their board and lodging for their services. The success and widespreading influence of his educational establishment gave a new impetus to modern education and made Germany the land of pedagogy. The institution founded in Halle still flourishes and retains a high moral tone. The system of public education established in Prussia by Frederick William I. is modeled after the plans of Francke. He published a number of works on religion and pedagogy.

FRANCO-GERMAN WAR, a military contest between France and Germany, caused chiefly by the jealousy of Napoleon III. of the growing importance of Prussia. Bismarck had determined to place Prussia at the head of a united Germany, owing to which Austria was excluded after the war of 1866, when the growing sentiment for German nationality threatened to isolate France. The crown of Spain was offered by General Prim to Leopold of Hohenzollern, a prince of the reigning family of Prussia, which excited the jealousy of Napoleon, who demanded that Leopold should retire as a candidate. Although the King of Prussia refused to demand this of Leopold, the latter declined the Spanish crown voluntarily, when Napoleon insisted that the King of Prussia should furnish a guarantee that the refusal would be final. This demand was of course refused, hence the French government formally declared war on July 19, 1870.

Both countries entered upon the prosecution of the war with marked enthusiasm, but France was comparatively illy prepared for the conflict. While that country had about 250,000 men ready to move forward in August, 1870, it had few available reserves. On the other hand, the North German Confederation was able to put 450,000 men into the field at once and had nearly that number of reserves available for active service. Napoleon had hoped that the South German States would refuse to join Prussia, but these, enthused with the sentiment of nationality, threw their influence against France. Three armies moved upon French territory, the first under General von Steinmetz at Trèves, the second under Prince Frederick Charles in Rhenish Palatinate, and the third under the Crown Prince of Prussia on the frontier of Baden.

The German armies, after winning successes at Weissenburg and at Wörth, succeeded in separating the two divisions of the French army under Marshals Bazaine and MacMahon. The former was repulsed in the Battle of Mars-la-tour, after which he took a position at Gravelotte, where he was defeated on August 18th by an army of 200,000 Germans. Bazaine now fell back upon Metz, where he was beseiged until in September, when he was compelled to surrender with an army of 175,000 men. In the meantime MacMahon was surrounded at Sedan, where he was defeated on September 2d and surrendered with an army of 83,000 men. Both Napoleon and MacMahon were among the prisoners of war.

The capture of Napoleon caused a revolution in Paris, where the republic was proclaimed two days after the fall of Sedan. However, the victorious armies marched upon Paris and placed it in a state of siege. Although efforts were made to relieve the capital, it was forced to surrender in February, 1871. The preliminary terms of peace with Germany were arranged by Thiers in the same month, and they were approved by the national assembly in March. France was required to cede Alsace and a part of Lorraine and pay a war indemnity of $1,000,000,000. It was provided in the treaty that German troops should occupy certain departments until the entire sum was paid. The final treaty of Frankfort was signed in May, 1871. As a result of the war, Germany was consolidated into an empire and France became a republic. See **War.**

FRANÇOIS (fräṅ-swä'), **Kurt von,** explorer, born in Luxembourg, Belgium, in 1853. He studied for a military life at Wahlstatt and Berlin, and in 1870-71 served in the German army, most of the time under his father, General François, who was slain in the Battle of Spichern. In 1883 he joined the exploring expedition of Wissmann for service in Africa, and was one of the earliest explorers who penetrated northwest from the coast of Togoland. He was military commander in German Southwest Africa a number of years and in 1891 acted as imperial commissioner, in which capacity he explored the region inland as far as Lake Ngami and defeated the Hottentots in several engagements. In 1895 he resigned his commission and subsequently settled in German Southwest Africa. Among his published works are "Explorations of the Kassai," "In the Interior of Africa," and "Discovery of the Tschuapa and Lulongo."

FRANCOLIN (frăṅ'kŏ-lĭn), the name of several species of birds related to the partridges, native to Asia and Africa. The plumage is variegated, but in most species it is a yellowish brown with black and white mark-

ings and the bill and tail are long. The flesh is much esteemed for food, hence these birds are hunted as game. When alarmed, they conceal themselves in the brushwood or run with considerable speed, taking wing only when they are in danger. They feed early in the morning and late in the evening, when they search for grains, insects, and bulbous roots. Their flight is accompanied by a whirring sound, and their cry, uttered chiefly when in search of food and at pairing time, is something like a shrill laughter.

FRANKFORT (frăn̲k'fŭrt), a city in Indiana, county seat of Clinton County, on Prairie Branch River, forty miles northwest of Indianapolis. It is on the Pennsylvania, the New York, Chicago and St. Louis, and other railroads, and is surrounded by a rich agricultural, dairying, and fruit-growing country. Among the noteworthy buildings are the county courthouse, the public library, the high school, and a number of fine churches. It has electric and gas lighting, street paving, and a sewerage system. Among the manufactures are pottery, bread, tile, flour, cigars, machinery, and ironware. It has extensive railroad machine shops. Population, 1900, 7,100; in 1920, 11,585.

FRANKFORT, a city of Franklin County, Kentucky, capital of the State and of Franklin County, on the Kentucky River, sixty miles east of Louisville. It is on the Louisville and Nashville and the Chesapeake and Ohio railroads, in the center of the blue grass region, and occupies a fine site on both sides of the river, which is spanned by a suspension bridge 700 feet long. The chief buildings include the State capitol, the State arsenal, the Governor's mansion, the State prison, an institution for feeble-minded children, and the State normal school for colored students. It has several fine monuments, including those erected to the soldiers who died in the War of 1812 and the Mexican War. The State library contains over 100,000 volumes.

Frankfort has manufactures of pottery, twine, barrels, lumber products, furniture, bread, cotton goods, and machinery. It has extensive systems of electric street railways, sewerage, and public lighting. Franklin Cemetery, on one of the hills near the city, contains the grave of Daniel Boone. Frankfort was founded in 1786 by Gen. James Wilkinson, and became the capital of the State in 1792. Population, 1920, 9,805.

FRANKFORT-ON-THE-MAIN, a city in the province of Hesse-Nassau, Germany, twenty miles northeast of Mainz, on the Main River. The older part has narrow streets and many buildings in which the high gables project over the walls, but the newer section is modern and has many fine residences and tall structures of steel and stone. Ziel street is the chief thoroughfare and merges into Kaiserstrasse. The market place, or Römerberg, is in the heart of the older part of the city. Many tourists are attracted to the house where Luther lived, the one in which Goethe was born, and the noted Rothschild Library. Besides the public schools, it contains the Städel Art Institution, a museum of history, and many important societies of literature and art. In its squares and public parks are numerous statues of celebrated citizens, among them those of Gutenberg, Goethe, and Schiller. The most prominent of its buildings include the Cathedral of Saint Bartholomew, the public hall, the opera house, the courts of justice, and the central railroad station, the depot being one of the finest in Europe. Frankfort is one of the wealthiest cities of modern Europe and contains the ancestral home of the Rothschilds. It holds high rank as a center of manufacturing and in the volume of its jobbing trade. The streets are generally paved with stone and asphalt and traversed by electric street railways. Systems of sewerage, waterworks, and gas and electric lighting are operated by the municipality. Among the manufactured products are perfumery, ironware, soap, chemicals, clothing, sewing machines, leather goods, and fabrics. It received its name from Charlemagne, who made it the seat of a political and religious council in 794. The city became Protestant as early as 1530. It was the place of meeting for the German diet in 1816-36. In the 13th century it became a free city and after 1562 it was the place of election and coronation of the German emperors. Here have been concluded many important peace treaties, among them the treaty closing the Franco-German War, which was signed in May, 1871. Among the banking and money markets of Europe Frankfort takes very high rank. Population, 1905, 334,978; in 1920, 414,598.

FRANKFORT-ON-THE-ODER, a commercial city in the province of Brandenburg, Germany, on the Oder River, about fifty miles southeast of Berlin. Several railroad lines connect it with the national capital and the cities of Central Europe. The noteworthy buildings include the Church of Saint Mary, the Reformed Church, the city hall, or Rathaus, the theater, and the railway station. Among the manufactures are leather, machinery, fabrics, clothing, chemicals, pottery, furniture, toys, and porcelain. The river is navigable and is connected by canals with the Elbe and Vistula, thus giving ample outlet for its manufactured products, jobbing trade, and passenger traffic. Telephones, electric railways, a public library, the gymnasium, waterworks, and an extensive system of gas and electric lighting are among the public utilities. The city became a free municipality in 1253 and was important as a member of the Hanseatic League. It suffered greatly during the Thirty Years' War. Nearly all the inhabitants are Protestants. Population, 1923, 68,230.

FRANKINCENSE (frăn̲k'ĭn-sĕns), a gum or resin, which, when burning, yields aromatic fumes and is used extensively as an incense in religious services. The Greeks and Jews, as

well as other ancient peoples, employed olibanum, the product of a tree found in India, and it is still employed chiefly in the East. In Europe and North America it is more common to use the exudations of certain coniferous trees, such as the silver fir, which are resinous products. They exude from the trees and harden by exposure to the air. The taste is balsamic and the odor when burning is pleasant.

FRANKING PRIVILEGE, the right of sending letters and packages by mail free of charge. This privilege was extended in England to members of Parliament by the Postmaster-General and later by statute, but it was abolished in 1840. Official correspondence and public documents are transmitted through the mails by officials of the government free of charge in most countries, though this privilege pertains only to business which is related strictly to certain officers of the Federal departments. The United States granted the franking privilege to soldiers of the Revolutionary War, but individuals have not had privilege to send mail in this way since 1873. Envelopes and wrappers of packages used for official purposes are marked *Official Business,* both in Canada and the United States, and in some countries stamps bearing the imprint *Official* are used. Persons not entitled to the privilege of sending mail in such wrappers or under such stamps are subject to a heavy fine in case they procure and use them.

FRANKLIN (frăn̲k'lĭn), or **Frankland,** the name of a proposed State formed by the inhabitants of what is now Tennessee. They revolted from the control of North Carolina in 1784, framed and ratified a constitution, elected a Legislature and State officers, and undertook to conduct a civil war against North Carolina. John Sevier, the Governor of Franklin, raised an army, but was defeated in an engagement and taken prisoner. In 1788 the Legislature of North Carolina pardoned the offenders in Franklin, and two years later the territory was ceded to the United States government, hence the disturbance was quieted.

FRANKLIN, a large district in the northern part of the Dominion of Canada, including the Arctic Archipelago. It is located chiefly north of the Arctic Circle, only a small portion of Baffin Land extending farther south. The chief islands are Grinnell Land, Prince Albert Land, North Devon, Melville Island, and Baffin Land. Animal and vegetable life are very scant and the inhabitants, consisting chiefly of Eskimos, are not numerous. Important fisheries and minerals abound. The area is about 500,000 square miles.

FRANKLIN, a city of Indiana, county seat of Johnson County, twenty miles south of Indianapolis, on the Pennsylvania, the Big Four, and other railroads. It has several fine county buildings and is surrounded by a fertile farming region. The manufactures include flour, desks, ironware, and machinery. It is the seat of Franklin College, a Baptist institution. Electric lights, waterworks, and a system of drainage are among the improvements. Population, 1900, 4,005; in 1920, 4,909.

FRANKLIN, a town of Massachusetts, in Norfolk County, 25 miles southwest of Boston, on the New York, New Haven and Hartford Railroad. It has a public library and a number of fine schools. The Dean Academy, a coeducational institution, is located here. The manufactures include rubber, clothing, and cotton and woolen goods. Franklin was incorporated in 1778. Population, 1905, 5,344; in 1925, 7,055.

FRANKLIN, a city of New Hampshire, in Merrimac County, 95 miles northwest of Boston, Mass., on the Boston and Maine Railroad. It is located at the junction of the Winnepesaukee and Pemigewasset rivers, which form the Merrimac at this place. Water power for manufacturing is utilized extensively and the industrial enterprises are well established. Needles, hosiery, machinery, paper, woolen goods, and clothing are the manufactures. Waterworks and electric lights are included among the public utilities. Franklin is the seat of the New Hampshire Orphans' Home, and is noted as the birthplace of Daniel Webster. It was incorporated in 1828 as a town and its city charter was issued in 1895. Population, 1900, 5,846; in 1920, 6,318.

FRANKLIN, county seat of Venango County, Pennsylvania, on the Allegheny River, about seventy miles north of Pittsburg. It is on the Erie, the Pennsylvania, and other railroads, and has a large trade in farm produce, coal, and merchandise. The county courthouse, the public library, and the high school are among the chief buildings. It has two public parks, street pavements, and sewerage and waterworks systems. Among the manufactured products are machinery, flour, fabrics, oil, vehicles, and engines. Valuable deposits of mineral oil and coal abound in the vicinity. Franklin was settled in 1753 and incorporated in 1795. Population, 1900, 7,317; in 1920, 9,970.

FRANKLIN, Battle of, an engagement of the Civil War in America, at Franklin, Tenn., on Nov. 30, 1864. General Hood, to counteract Sherman in his march to the sea, had taken a large force of Confederates into Kentucky and Tennessee, and was threatening an invasion of the states farther north. General Thomas, who had been with Sherman's army was sent north to Nashville, and General Schofield operated with a Federal force against Hood's army. Schofield strengthened his position at Franklin, on the Harpeth River, where he was attacked by the Confederates, who made desperate assaults, but were beaten back each time with considerable loss. The Federals withdrew to Nashville during the night, where they joined the army under Thomas. The Federals engaged in the Battle of Franklin numbered 25,000, while

the Confederates had about 40,000 men. Both sides fought with remarkable gallantry.

FRANKLIN, Benjamin, eminent statesman, born in Boston, Mass., Jan. 17, 1706; died in Philadelphia, Pa., April 19, 1790. He was the fifteenth of the seventeen children of Josiah Franklin, who emigrated to America in 1685. His father was a tallow chandler and soap boiler. Benjamin was apprenticed as a printer to his elder brother, who founded the *New England Courant,* and developed much fondness for books and writing. When seventeen years of age, he went to Philadelphia, where he arrived with $1.25, and by prudent economy saved sufficient to purchase the *Pennsylvania Gazette* in 1727, which had been started by Mr. Keimer. The following year he married Deborah Read, the daughter of a man with whom he had boarded when he first came to Philadelphia.

BENJAMIN FRANKLIN.

Franklin was appointed deputy general of the British colonies in 1753, and the next year served as a member of the Albany convention, in which he proposed an important plan for colonial union. During his leisure he experimented with scientific matters, for which purpose he fitted up a small laboratory, and made discoveries regarding the theory of positive and negative electricity. By the use of a kite he demonstrated that electricity and lightning are identical, and subsequently invented the lightning rod or conductor. His *Poor Richard's Almanac,* founded in 1732, was published until 1757, and was the source of some profit. It was a medium of considerable utility in the educational affairs of the colonists. He was the agent of Pennsylvania in England in 1757-62, and again from 1764 until the Revolution. A part of the intervening time he represented New Jersey, Massachusetts, and Georgia at the English court.

While Franklin's early education was limited, he ranked as a versatile reader from early youth. He obtained a wide fund of knowledge by self-activity, was elected a member of the Royal Society of England, and was granted academical degrees by Oxford and Edinburgh. In 1774 he presented the first petition of the American Congress to the king of England and was elected a member of Congress on returning to America. He favored the Declaration of Independence. In 1776 he was sent as commissioner plenipotentiary to France for the purpose of securing an alliance between that country and the United States, in which position he rendered valuable service to the American cause. The benefits accruing from his negotiations included loans of very large sums of money and later other valuable concessions. After the surrender of Burgoyne, he concluded an alliance with France, subsequently made a treaty with England, and later obtained a commercial treaty with Prussia. On his return from England, in 1785, he was chosen president of Pennsylvania. That State sent him as a delegate to the Federal convention in 1787 for the purpose of aiding in the formation of the Constitution, which, when completed, met his hearty approval.

Besides his *Poor Richard's Almanac,* he produced numerous papers on scientific subjects and on political economy and anti-slavery questions, but died before completing his "Autobiography," which is still read extensively in public schools. His grave and that of his wife are in the yard of Christ Church, Philadelphia, at the corner of Fifth and Arch streets. In early life he wrote a fanciful epitaph for himself, but it is not inscribed on the plain marble stone which covers his grave. It is a famous production, as follows:

"The Body
of
Benjamin Franklin, Printer,
(Like the cover of an old book,
Its contents torn out,
And stript of its lettering and gilding,)
Lies here food for worms.
Yet the work itself shall not be lost,
For it will (as he believed) appear once more
In a new
And more beautiful Edition,
Corrected and Amended
By
The Author."

FRANKLIN, Sir John, naval officer and explorer, born in Lincolnshire, England, April 16, 1786. He was the youngest son of an agriculturist, attended school at Saint Ives and Louth, and in 1800 entered the navy as a midshipman. The following year he took part in the Battle of Copenhagen. In 1801-03 he accompanied Captain Flinders on a voyage of discovery to Australia. On returning to England he was appointed to the *Bellerophon,* and at the Battle of Trafalgar managed her signals. In 1819 he conducted an exploring expedition from Hudson Bay to the interior of Canada, made a second expedition in 1825-27, and was knighted in 1829. In 1836-43 he was governor of Tasmania, two years later took command of the *Erebus* and *Terror,* and with an escort of 134 men and officers started upon an expedition of discovery to the Arctic seas, sailing from England on May 18, 1845, but he never returned. A document deposited in a cairn in 1847, and found in 1850, gave the latest details of the ill-fated expedition. From this it was learned that Franklin died June 11, 1847, that the crew abandoned the ship April, 1848, and that the survivors, 105 in number, entered upon a march to the Great Fish River. Although a

THE FRASER CANYON

In the narrow canyon of the Fraser River the persistence of man has built a railway that runs mile after mile along the edge of a dizzy precipice. Far below it rolls the river, swift, silent, and green with depth, while above it lower threateningly great cliffs on which struggling mountain shrubs here and there find a scant foothold.

(Opp. 1057)

number of relics of the company have been discovered, none of the party survived.

FRANKLIN, William Buel, soldier, born in York, Pa., Feb. 27, 1823; died in 1903. He studied at West Point, where he graduated in 1843, and was assigned to the corps of topographical engineers. In the Mexican War he was brevetted lieutenant for valuable service at Buena Vista and was made captain in 1857. He was appointed colonel in 1861, and as such officer commanded a division in the Battle of Bull Run. He took part in the Battle of White Oak Swamp, 1862; the Battle of South Mountain, 1862; and the Battle of Fredericksburg, 1862. Subsequently he was assigned to the Department of the Gulf. In 1864 he took part in the Red River Expedition and conducted the retreat to Alexandria. He was brevetted major general in the regular army in 1865, but retired the following year to engage in the manufacture of firearms at Hartford, Conn. In 1889 he was commissioner to the Paris Exposition, where he was awarded the insignia of grand officer of the Legion of Honor.

FRANKS, the name of a number of German tribes that inhabited the regions of the Lower Rhine in the 3d century. They defeated the Romans in Gaul and controlled France from that time until the rise of the Capetian dynasty in 987, giving to that country the Merovingian dynasty, from 481 to 987. For security against hostile tribes, they lived in villages. They committed their laws to writing, were industrious, and gave France the Salic laws. The descendants from these peoples now form the chief Germanic element of northern France and the western part of Germany.

FRANZ JOSEPH LAND (fränts yō'zĕf), an island archipelago in the Arctic Ocean, north of Nova Zembla. It was discovered by the Payer-Weyprecht expedition in 1873 and was named in honor of the Emperor of Austria, Francis Joseph I. The group includes about sixty islands, many of which are separated from each other by deep and narrow fiords and channels. They include Zichy Land, Wilczek Land, and Alexandra Land. The surface is generally rocky and level, from 150 to 500 feet above the sea, and several peaks have an altitude of 2,800 feet. Grass, mosses, and lichen are the chief plants. Polar bears, foxes, seals, and wild fowls are plentiful. The islands are not inhabited by man.

FRASER (frā'zĕr), the largest river of British Columbia, rises in the lake region of the Rocky Mountains. It has a general course toward the south, and, after flowing 740 miles, discharges into the Gulf of Georgia. The Fraser is navigable for more than 150 miles, contains valuable salmon fisheries, and flows through a mineral country rich in gold and silver deposits. Its principal tributaries are the Stuart, Thompson, and Chilcoten rivers. The lower valley, which is very fertile, is traversed by the Canadian Pacific Railway. Among the towns on its banks are New Westminster, Hope, Yale, and Lytton.

FRASERVILLE, a town of Temiscouata County, Quebec, 125 miles northeast of Quebec, on the St. Lawrence River and on the Intercolonial and on the Temiscouata railways. It has paving, gas and electric plants, saw mills, furniture factories, and machine shops. The features include the courthouse, city hall, federal building, and several churches. It was incorporated in 1874. Population, 1921, 7,714.

FRATERNAL SOCIETIES (frà-tĕr'nąl). See **Benefit Associations.**

FRATERNITIES, the name applied to various organizations of students in the colleges and universities of the United States. They are frequently termed College Secret Societies, or Greek-letter Fraternities, and members of them are sometimes spoken of as *Frats.* The names are taken from several letters of the Greek alphabet, as *Phi Beta Kappa,* and from these the secret motto of the fraternity is remembered, since these letters are the beginning of the words in the motto. The fraternities are composed of chapters, the latter being branches in the various colleges that belong to a particular fraternity. The largest number of members belong to the academic departments.

The first Greek-letter society was organized at the College of William and Mary, Virginia, in 1776, and named *Phi Beta Kappa.* Its purpose was announced to be friendly intercourse and literary advancement among scholars. However, the present fraternity system of the United States originated in 1825, when a number of students of Union College, New York, organized the *Kappa Alpha.* Similar organizations which are maintained by young women who attend colleges and universities are known as sororities. The first of these, known as *Kappa Alpha Theta,* was organized in 1870 at De Pauw University, Indiana. Since then many others have been established. The members who attend college are styled *active* and afterward they become known as *alumni.* Catalogues, magazines, and song books are published by many of the fraternities and a large number maintain chapter houses. Though opposition to societies of this kind has sprung up, they are defended by many leading educators, who have generally expressed their belief in the practical utility of college fraternities.

FRAUD, in law, any cunning or deception used to cheat or deceive another. It is essentially a false representation of some matter of fact, and is intended to deceive another as to his legal injury. The law distinguishes a false representation of fact, which is necessary in committing a fraud, from a mere expression of opinion. Frauds are classed as either actual or constructive. An *actual fraud* is one in

which the perpetrator is guilty of dishonest intention. *Constructive fraud* consists of acts which may not be dishonest in intention, but which are considered in law as being in bad faith. The case of a person charged with the duty of selling property for another, in which he himself is the purchaser, is considered constructive fraud, since it is assumed that he will make the purchase at the best price possible. A party who is guilty of fraud may be punished under the criminal code and at the same time be required in a civil suit to return the goods or settle the damages sustained by the owner.

FRAUNHOFER (froun'hō-fĕr), **Joseph von,** noted optician, born in Bavaria, Germany, March 6, 1787; died in Munich, June 7, 1826. After serving as an apprentice to a glass polisher, he entered upon a study of optics, and became a celebrated manufacturer and inventor. The superiority of his optical instruments enabled him to discover dark lines fixed on the solar spectrum, called *Fraunhofer's lines.* Later he found similar lines in the spectra of the moon and several of the planets. These discoveries led to the invention of the spectroscope and the development of the science of spectroscopy. Later he invented several devices useful in microscopy, a form of heliometer, and the stage micrometer. In 1817 he was elected a member of the Munich Academy of Sciences.

FRÉCHETTE (frā-shĕt'), **Louis Honoré,** poet, born at Point Levi, Quebec, Nov. 16, 1839. He was educated at Quebec Seminary and Laval University and in 1864 became a member of the bar. In 1874 he was elected to the Dominion Parliament, serving until 1879, when he engaged in journalism at Quebec. He was editor of three French newspapers, published respectively in Quebec, Montreal, and Chicago, and for some time served as president of the Royal Society of Canada. He wrote largely in the French language and is rightly considered one of the most able Canadian poets. A number of English works were translated into French by him, including Cable's "Creole Days" and Howell's "A Chance Acquaintance." Among his chief productions are "Veronica," "My Leisure Hours," "Pell-Mell," "The Legend of a People," and "Christmas in French Canada." He died June 1, 1908.

FREDERIC (frĕd'ĕr-ĭk), **Harold,** author and journalist, born in Utica, N. Y., Aug. 19, 1856; died Oct. 19, 1898. He worked on a farm during his early life and attended the public schools at Utica. Subsequently he became a proofreader in a newspaper office and in 1881 was chosen as editor of the Albany *Journal.* In 1884 he went to England as correspondent of the New York *Times* and resided there until his death. His writings treat largely of rural life in central New York and with the middle class of America. In 1891 he published "The New Exodus," a study of the Jews in Russia. Among his books are "The Lawton Girl," "Seth's Brother's Wife," "In the Valley," and "The Damnation of Theron Ware."

FREDERICK (frĕd'ĕr-ĭk), a city in Maryland, county seat of Frederick county, 32 miles northwest of Washington, D. C. It is on the Pennsylvania and the Baltimore and Ohio railroads. The surrounding country is agricultural and contains rich deposits of iron, copper, slate, and limestone. It is the seat of a fine school system, Frederick College, and a State asylum for the deaf and dumb. Among the noteworthy buildings are the county courthouse, the Emergency Hospital, and the public library. It has manufactures of flour, coaches, tobacco and cigars, machinery, and woolen goods. The public utilities include waterworks, sewerage, and street paving of stone and macadam. The two battles of South Mountain and Monocacy occurred near the city. Francis S. Key was a native of the county and is buried in Mount Olivet Cemetery. Frederick was settled in 1745 and incorporated in 1817. The first Methodist church in America was organized here by Robert Strawbridge in 1764. Population, 1900, 9,296; in 1920, 11,066.

FREDERICK I., Holy Roman Emperor, surnamed Barbarossa, born in 1121; died June 10, 1190. He was the son of Frederick II., Duke of Swabia, succeeded his father as Duke of Swabia in 1147, and secured the imperial crown in 1152 as successor to his uncle, Emperor Conrad III. His long reign was distinguished principally by a series of wars against the Italian principalities and other neighboring powers and various complications with the Pope. In 1162 he conquered Milan and five year later laid siege to Rome, but his army sustained a marked defeat at Legnano in 1176. He immediately recruited his army and turned his attention to conquering vassals in Germany and crushing the wealthy Guelphs. Later he made Poland tributary and reduced Bohemia, Austria, and Denmark. Having made himself master of Western Europe, he invaded Asia Minor and defeated the Mohammedans in several battles at Iconium and Philomelium, but on Jan. 10, 1190, was drowned in the Calycadnus, a small river in Cilicia. His sudden death had a depressing influence upon the Crusaders and excited profound grief in Germany, where his memory has always been cherished as one of the wisest and bravest of the nation. He enacted admirable laws, patronized learning, built valuable internal improvements, and solidified the spirit of nationalism in his dominion.

FREDERICK I., first King of Prussia, third Elector of Brandenburg, born in Königsberg, July 22, 1657; died Feb. 25, 1713. He was crowned at Königsberg on Jan. 18, 1701.

Shortly after he sent an army of 20,000 men to take part in the Spanish Succession War, of which a portion served with distinction at the Battle of Blenheim. He wielded much influence by placing auxiliary forces at the disposal of friendly adjacent princes, and assisted the Duke of Orange in his expedition against England to secure the throne. Internal affairs were greatly improved by the founding of institutions of learning, among them the University of Halle, and the encouragement of arts and sciences. He pursued the policy of his father, Frederick William, elector of Brandenburg, in defending Protestantism.

FREDERICK II., King of Prussia, known as Frederick the Great, born in Berlin, Jan. 24, 1712; died Aug. 17, 1786. His early education was devised by his father and consisted of an extremely rigorous course intended to harden him for the conduct and life of a soldier. He married Princess Elizabeth Christina of Brunswick in 1733, and became king on May 31, 1740. He maintained the governmental forms established by his father, but possessed greater liberality and ruled with a spirit of enlightenment. Charles VI. of Austria died the year that Frederick ascended the throne, and the latter at once began extensive military preparations for the purpose of taking possession of Silesia. He invaded that province with an army of 30,000 men, defeated the Austrians at Mollwitz in 1741 and near Czaslau in 1742, and by the Treaty of Breslau secured Glatz and Upper and Lower Silesia. The opposition of Maria Theresa, Queen of Austria, led to a second war in 1744, which terminated by the Peace of Dresden, in 1745, and assured the permanent possession of Silesia. By these successes Frederick raised himself to the height of power as a sovereign of his time.

FREDERICK THE GREAT.

After eleven years of peace, in 1756, the Seven Years' War began, for which he had made an alliance with England and was opposed by France, Austria, Russia, Sweden, and Saxony. Though the fortunes of war were against him in several minor engagements, he was generally successful, defeating the opposing armies in numerous decisive battles, and by the Treaty of Hubertsburg, in 1763, confirmed his title to Silesia. To recover from the terrible ravages of war he melted the silver in his palaces into money, encouraged internal industries, and soon paved the way for an era of prosperity. In 1764 he concluded an alliance with Russia, adding Polish Prussia and Great Poland to his possessions, strengthened the army, and by continual economy accumulated the immense sum of 70,000,000 *thalers*. His chief trust was in his treasury and in his army. Having provided the former, he organized the latter by securing 200,000 sturdy men, disciplined with the greatest strictness under his own supervision. His death occurred from an exposure at a military review. When viewed in the light of sagacity, energy, and enlightenment, history recognizes in him one of the greatest figures of modern times.

FREDERICK I., Emperor of Germany, Frederick III. of Prussia, son of William I., born in Potsdam, Oct. 13, 1831; died June 15, 1888. He studied at Bonn, and secured military training under von Moltke, and took an efficient part in suppressing the revolution in 1848. In 1857 he married Victoria Adelaide, eldest daughter of Queen Victoria of England. During the war with Austria, in 1866, he was a prominent leader, and had personal command of an important position in the Battle of Sadowa. He commanded the army corps that invaded Lorraine and Alsace in the Franco-German War of 1870-71, was made field marshal general and, after the organization of the new empire, assisted his father in the administration. Later he traveled in foreign countries, studied the civil and political institutions of Eurasia, and on March 9, 1888, succeeded his father as Emperor of Germany. Though having a profound military training, he was an ardent advocate of peace, which made him universally popular. In 1887 he became afflicted with throat trouble and underwent a critical surgical operation. He died three months after ascending the throne.

FREDERICK II., King of Sicily, born near Ancona, Italy, Dec. 26, 1194; died in 1250. He was a grandson of Frederick I. of Germany and of Emperor Henry VII., and was under the guardianship of Pope Innocent III. until 1208. In the latter year he assumed the government of Sicily and the southern part of Italy. In 1212 he began a contest for the throne of Germany, in which he was supported by the Pope, but he did not succeed until Otho IV. was defeated by Philip Augustus of France in the Battle of Bouvines. He was crowned Holy Roman Emperor in 1215, when he took a vow to undertake a crusade, but he did not start upon his mission to Asia until 1227. The following year he concluded a truce with the Sultan of Egypt, who surrendered the territory around Jerusalem and Nazareth and recognized Frederick as King of Jerusalem. On returning to Italy, he conducted a military campaign to subdue Lombardy, and sought to limit the powers of the Pope in temporal affairs. He was noted for his learning and talents as a minnesinger and did much to fur-

ther interest in commerce and agriculture. However, he impoverished Germany by costly and useless wars.

FREDERICK VIII., King of Denmark, eldest son of Christian IX., born June 3, 1843; died May 14, 1912. He studied at Oxford, England, and in 1869 married Princess Luise of Sweden, a niece of Oscar II. The eldest of their eight children, Prince Christian, is the Crown Prince of Denmark. Their second son, Prince Karl, became King of Norway in 1905 with the title of Haakon VII. Frederick VIII. ascended the throne of Denmark as successor to his father on Jan. 29, 1906. He administered the affairs of the kingdom with sagacity. His son, Christian X., succeeded him.

FREDERICK VIII.

FREDERICK CHARLES NICHOLAS, noted soldier and field marshal, born in Berlin, Germany, March 20, 1828; died June 15, 1885. He was a nephew of Emperor William I., secured a strict military training, served in the first Schleswig-Holstein War, and defeated the Austrians in 1866 at Königgratz. In 1870 he drove Bazaine into Metz, and on Oct. 27, 1870, received the surrender of the fortress together with 180,000 men. Later he captured Orleans, defeated General Chanzy at Le Mans, and destroyed the army of the Loire. After the close of the war he became inspector of cavalry in Prussia. In 1879 his daughter, Louise Margaret, married a son of Queen Victoria, the Duke of Connaught. He ranks as an efficient commander and strategist, and was called "Red Prince," from the color of the red hussar uniform that he usually wore.

FREDERICKSBURG, a city in Spottsylvania County, Virginia, about sixty miles north of Richmond, on the Richmond, Fredericksburg and Potomac and the Potomac, Fredericksburg and Piedmont railroads. It is surrounded by a hilly but productive country. The site is on the Rappahannock River, which is crossed by several bridges, and is noted for its beautiful Confederate and civilian cemeteries. It has a public park, a fine high school, and a library. The manufactures include cigars, leather, flour, silk and woolen goods, and machinery. It was incorporated in 1782. Population, 1900, 5,068; in 1920, 5,860.

FREDERICKSBURG, Battle of, one of the important battles of the Civil War. It occurred at Fredericksburg, Virginia, on Dec. 13, 1862. General Burnside had resolved to march upon Richmond, and, accordingly, moved his troops to the heights opposite Fredericksburg, on the north side of the Rappahannock. His army consisted of 125,000 men, the right wing of which was commanded by Sumner, the center by Hooker, and the left by Franklin. The army under General Lee numbered 80,000 men, with Jackson as commander of the right wing and Longstreet of the left. The Federal forces crossed the river by three pontoon bridges in the two days preceding the battle. It was planned that Burnside should make the chief attack and hold the road, while Sumner and Hooker should carry the stone wall which ran along the foot of the hill and ultimately storm the heights. An insufficient number of troops had been assigned to Franklin to effect the object intended. The attacks made by Hooker and Sumner were unsuccessful, but failed largely for want of support from Franklin. The Confederate loss was 5,250, while the Union army lost 12,350, and the entire battle proved disastrous to the Federals. Two days later Burnside withdrew from Fredericksburg, and he and Franklin were relieved of their commands shortly after. General Hooker was appointed to succeed Burnside in command of the Army of the Potomac.

FREDERICK WILLIAM, Elector of Brandenburg, born in Berlin, Feb. 16, 1620; died May 9, 1688. He, next to Frederick the Great, was the chief founder of Prussian power and is known as the Great Elector. He ascended the throne at a time when the treasury was empty and the country devastated by the Thirty Years' War, but immediately pursued a vigorous policy in replenishing the treasury. After making a treaty of neutrality with Sweden, he successfully maintained the independence of Prussia and strengthened the means of national defense. In 1675 he drove the Swedes from Pomerania and Brandenburg, after defeating them at Fehrbellin, and otherwise extended and strengthened his dominion. Frederick III., his son, succeeded him and afterward became Frederick I. of Prussia.

FREDERICK WILLIAM I., King of Prussia, son of Frederick I., born in Berlin, Aug. 15, 1688; died May 31, 1740. He was imbued with a passion for military achievement, but gave evidence of much sagacity and devotion to the improvement of his country. In 1715 he added the islands of Usedom, Wollin, Stettin, and a part of Swedish Pomerania, which he secured as a partial war indemnity from Charles XII. of Sweden. The succeeding years of his reign were devoted entirely to internal improvements, higher learning, and the administration of justice. Schools, colleges of industry, and other centers of learning were established and an effective army was organized. At the time of his death Prussia possessed the best disciplined army of Europe, which num-

bered 80,000 men, and the largest national deposit of cash, a sum equal to $6,750,000. He was succeeded by his son, Frederick the Great.

FREDERICK WILLIAM II., King of Prussia, nephew of Frederick the Great, born Sept. 25, 1744; died Nov. 16, 1797. His reign was distinguished by favoritism, extravagance in public expenditure, strict censorship of the press, and abridgment of clerical powers. In 1794 he enlarged the kingdom by annexing a portion of Poland. The total amount of territory added by him through conquest, purchase, and inheritance included 46,000 square miles. Under his direction the code of laws prepared by Frederick the Great was revised and introduced.

FREDERICK WILLIAM III., King of Prussia, eldest son of Frederick William II., born Aug. 3, 1770; died June 7, 1840. He married Princess Louisa, daughter of the Duke of Mecklenburg-Strelitz, who possessed lofty impulses and aided him in many national enterprises. Upon ascending the throne, he surrounded himself with capable ministers and removed the principal causes for grievance instituted by his father. He was required to surrender some territory to Napoleon in 1801, but secured Hanover in return. Afterward he was compelled to form an alliance with France, though this terminated shortly after the return of Napoleon from Moscow, and later he gained advantage by the battles at Leipzig and Waterloo. After the conclusion of a long series of wars, he labored sincerely to restore prosperity, and brought about some constitutional reforms in the government.

FREDERICK WILLIAM IV., King of Prussia, son of Frederick William III., born Oct. 15, 1795; died Jan. 2, 1861. He married Princess Elizabeth of Bavaria in 1823, but left no issue. His opposition to the new constitution established by his father was a direct cause of the revolution of 1848. The following year he was offered the title of emperor, but declined it. Shortly after he summoned a national parliament at Erfurt for the purpose of uniting the German states under a new constitution, which finally resulted in the establishment of a representative parliament. Through it the German states were solidified and a spirit of nationalism developed. A stroke of paralysis, which affected him in 1857, largely clouded his mind and led to the appointment of his brother William as regent on Oct. 7, 1858, who afterward became his successor as William I.

FREDERICTON (frĕd′ĕr-ĭk-tŭn), a city of Canada, capital of New Brunswick and of York County, on the Canada Eastern, the Canadian Pacific, and other railways. It is located on the Saint John River, 60 miles northwest of Saint John, 84 miles from the Bay of Fundy. It has broad and well-improved streets and is important as a commercial and manufacturing center. The chief architectural structures include a hospital, the legislative library, a customhouse, several schools, and the Parliament buildings. It is the seat of an Anglican bishopric and of the New Brunswick University. Among the manufactures are lumber products, leather, machinery, and boots and shoes. The domestic and foreign trade is important, owing to its convenient location on railways and on the Saint John River, which is navigable for large vessels to this point. It was founded as Saint Anne in 1740. The name was changed to Fredericton in 1785, and two years later it became the capital of New Brunswick. Population, 1921, 8,114.

FREDONIA (frē-dō′nĭ-à), a town of New York, in Chautauqua County, 45 miles southwest of Buffalo, on the Valley Branch of the New York Central Railroad. It is the seat of a State normal school. Among the enterprises are vineyards, canneries, nurseries, and fruit shipping activities. It has a public library, waterworks, and several fine schools. The first settlement in its vicinity was made in 1803 and it was incorporated in 1829. Population, 1905, 5,148; in 1920, 6,051; in 1925, 6,293.

FREE CHURCH, the general name of a religious denomination which originated from an established church. The most important are the Free Church of England and the Free Church of Scotland. The former is a Protestant Episcopal organization founded in 1844. While the ritual is practically identical with that of the national church, it is free from state control, and claims the liberty of establishing a liturgical service on an evangelical basis. The Free Church of Scotland became a separate body in 1843, when it organized as a branch of the Presbyterian church, as distinct from the Established Church. The separation was brought about by a law of the general assembly passed in 1834, which provided that a majority of the male heads of families, who were full members of the church, could veto or bar the appointment of a minister who was not acceptable to a parish church. This act of legislation caused a conflict between the civil and ecclesiastical powers, but the House of Lords, in 1839, set aside a decision of the civil courts which had annulled the act, hence a large number of members, under the leadership of Chalmers and Candlish, established the Free Church of Scotland. While it renounced the benefits of establishment, it maintains the doctrine and discipline of the Church of Scotland.

FREE CITIES, a name applied to cities that form independent governments or states by themselves. At the time of the French Revolution there were about fifty free cities in Europe, mostly members of the German Confederation, but at present there are only three, the cities of Lübeck, Bremen, and Hamburg, and they retain their privileges under the re-

constituted German Empire. All others lost their special privileges on account of international political changes.

FREEDMEN'S BUREAU (frēd'mẹnz bū'rō), formerly a branch of the War Department of the United States, organized by an act of Congress in 1865 with the view of providing for the needs of liberated slaves, and to aid in fitting them to become self-supporting citizens. Gen. O. O. Howard was appointed commissioner. The bureau was discontinued in 1870. In the five years of its existence it handled a fund of nearly $20,000,000, which was raised by grants, bounties, and prizes, and gave valuable assistance to the freedmen during temporary need.

FREELAND (frē'lạnd), a borough of Pennsylvania, in Luzerne County, 38 miles south of Wilkesbarre, on the Lehigh Valley Railroad. It is surrounded by a farming and anthracite coal mining region. The manufactures include hardware, machinery, cigars, and clothing. It has a growing market in merchandise, coal, and produce. Population, 1920, 6,197.

FREEMAN, Edward Augustus, educator and historian, born in Harborne, England, Aug. 2, 1823; died in Alicante, Spain, March 16, 1892. He was educated at Trinity College, Oxford, and became a fellow there in 1845. In 1857-58 he was examiner in the School of Law and Modern History and again in 1863-64, and was appointed to a similar position in the School of Modern History in 1873. Subsequently many honorary degrees were granted him, among them one each by the University of Cambridge and the University of Saint Petersburg. His work in history, both as a writer and teacher, was distinguished on account of its searching and accurate characteristics, and for the extensive manner of treatment of various themes. His writings include works on architectural history and parliamentary subjects. They were published both as contributions to periodicals and in book form. Among his best known works are "The History of the Norman Conquest," "Historical Geography of Europe," "Ottoman's Power in Europe," "A History of Architecture," "Some Impressions of the United States," "Lectures to American Audiences," "Travels in Greece and Italy," and "Greater Greece and Greater Britain." His writings on American subjects were published after he traveled in Canada and the United States, in 1881-82.

FREEMAN, James, clergyman, born in Charlestown, Mass., April 22, 1759; died in Newton, Mass., Nov. 14, 1835. His training was in the Episcopalian Church, but he afterward adopted Unitarian tenets. In 1777 he graduated at Harvard, organized the first Unitarian society of America, and preached in the Episcopal church in Boston, which subsequently became the first Unitarian church in New England. His work spread rapidly to many portions of the United States. Harvard conferred upon him the degree of doctor of divinity in 1811, and later he became a founder of the Massachusetts Historical Society. His most important work is entitled "Sermons and Charges."

FREEMAN, Mary Eleanor Wilkins, novelist, born at Randolph, Mass., in 1862. She was educated at Brattleboro, Vt., and at Mount Holyoke Seminary. In 1887 she published "A Humble Romance," in which she portrayed much ability in delineating New England characters. She was awarded a prize, in 1895, for writing the best story of less than 6,000 words, although 3,000 competitors took part in the contest. In 1902 she married Charles M. Freeman and took up her residence at Metuchen, N. J. Among her chief writings are "Young Lucretia," "A New England Nun," "The Love of Parson Lord," "The Portion of Labor," "The Wind in the Rose Bush," "Silence and Other Stories," and "The Jamesons, and People of Our Neighborhood."

FREEMASON (frē'mā-s'n), a member of a secret fraternity known as the Freemasons, which dates from the Middle Ages. Originally membership was limited to skilled artisans, but now it includes a far wider range, and the fraternity has branches and lodges in all civilized countries. The present form of organization was adopted in 1717, when the fraternity was reorganized on the avowed principles of charity, brotherly love, and mutual assistance. According to the legends of the craft, it is traced back through the centuries to the building of Solomon's temple, and according to some to the tower of Babel and the building of Noah's ark. Many interesting details are given as to its early organization. Its slow but steady development is traced from the times of Solomon, Hiram, King of Tyre (II Samuel v., 11), the Pharaohs, the ancient Roman nation, and lastly the Knights Templar.

The modern fraternity of Freemasons has its true source in the building corporations maintained in the mediaeval period, when members of those organizations passed to different portions of Europe to hew stone and construct massive and durable forms of architecture. Certain signs and passwords were used by the skilled workmen, which served as a sign of fraternity, efficiency, and worthiness, such signs being kept a secret among the craft. The most distinct types of production by the stonemasons are found in the monasteries and other massive edifices of Germany. In England they date from 926, when a conference of masons was held at York, attended by King Athelstan. In the 12th century they proceeded to Scotland, of which fact many massive abbeys give evidence. The reorganization of 1717 occurred at London, while branches were established in France in 1725; America, in 1730; Russia, in 1731; Germany, in 1740; and later

in all civilized countries. From the first branch lodge established in New Jersey sprang many thousands of others, until at present there are sixty grand lodges in the United States and British America, about 12,000 subordinate lodges, and a membership of 1,198,845.

Findel's "History of Freemasonry," translated into the English in 1889, is the most scientific and complete work on the subject of Freemasonry. It contains an intensely interesting account of the growth and development of the fraternity. At various times, like other secret societies, it has been declared useless and harmful by divers religious councils. In the United States and elsewhere there are numerous degrees, to which applicants are initiated under a system of instruction and tests.

The election of new members is by ballot and various signs, passwords, and grips are given, by which members in need of assistance and succor may be tested before more than ordinary or usual benefits are extended. The grand and subordinate lodges elect officers by ballot, who are eligible to reëlection. Careful study of a suitable course is incumbent upon the members and officers, in order to secure the greatest degree of efficiency and skill in conducting the business appertaining to the fraternity.

FREE METHODISTS, a Protestant sect organized at Pekin, N. Y., in 1860. It is an outgrowth of the Methodist Episcopal church, and was formed by the followers of two ministers who did not approve of the decisions of a conference held at Genesee, N. Y., on points of Christian practice. In the main Free Methodists agree with the Methodist Episcopal church on points of doctrine. They do not recognize the office of bishop, but instead have an elective superintendent, who serves four years. The singing in churches is strictly congregational, without instrumental music, and the seats in the church are free. They insist upon plainness of dress and simplicity in living, approve of and practice freeness in prayer and testimonial meetings, and encourage extemporaneous preaching. The doctrine of Christian perfection is insisted upon. The church has about 42,500 members, 1,200 church buildings, and promotes religious work through Sunday schools and protracted meetings. Missions are maintained in all the continents. The *Free Methodist,* published in Chicago, is one of the leading church journals.

FREEPORT (frē'pôrt), a city and the county seat of Stephenson County, Illinois, 108 miles northwest of Chicago, on the Pecatonica River. It is on the Illinois Central, the Chicago and Northwestern, and the Chicago, Milwaukee and Saint Paul railroads, and has communication by electric railways. The chief buildings are the courthouse, the public library, and the Saint Francis Hospital. Besides having a fine public school system, it is the seat of Freeport College, a Presbyterian institution founded in 1872. Among the manufactured products are bread, brick, windmills, farm machinery, vinegar, hardware, and cigars. Douglas and Lincoln had a noted debate at Freeport in 1858, when the former declared a doctrine regarding Dred Scott case which afterward became known as the *Freeport heresy.* The vicinity was settled in 1835 and Freeport was chartered as a city in 1885. Population, 1920, 19,669.

FREE PORTS, a name applied to ports at whose wharves vessels of all nations are permitted to load, reload, or unload free of commercial charges and customs duties, paying only a nominal harbor fee. Free ports were established in the Middle Ages for the purpose of attracting trade to certain cities, and these enjoyed special advantages when prohibitive or protective customs went into effect in other commercial centers. Since 1888 the free port cities have become greatly limited, among the few remaining in Europe being Hamburg, Bremen, and Trieste. Those not European include Hongkong, Singapore, Livingstone, in Guatemala, and several others.

FREE-SOIL PARTY, a political party of the United States, organized at Buffalo, N. Y., in 1848. It maintained an opposition to the extension of slavery as its cardinal principle. At first it was made up of different minor parties, such as the Barnburners, Liberty party, Whigs, and Abolition party. The first candidate for President of the Free-Soil party was Martin Van Buren and its last was John P. Hale, the former in 1848 and the latter in 1852. As neither candidate received a considerable number of votes, the party was merged into the newly formed Republican party in 1856.

FREETHINKERS (frē'thĭnk-ẽrz), a term originated in England and applied to a class of deists in the 17th and 18th centuries, who held tenets in favor of natural as against revealed religion. In the time of Frederick the Great the term began to be used in Germany. In France it was applied to such writers as Diderot, Voltaire, and Helvetius, and in England it had reference to a class which included Hume and Lord Bolingbroke. At present the term is common among Christians as well as others, since it is taken to designate rationalism.

FREETOWN, a city of West Africa, capital of the British colony of Sierra Leone, about five miles from the Atlantic coast. It is located on the Sierra Leone River, 32 miles by rail from Songotown, and is surrounded by a low tract, which is separated from the inland by a chain of mountains. The chief buildings include a mission house, a supreme court, a cathedral, and a number of schools. It is an imperial coaling station and has a large export trade in palm oil, hides, India rubber, and fruits. The city has only about 200 European inhabitants. Population, 1922, 38,063.

FREE TRADE, the term applied to national

and interstate commerce when it is unrestricted by tariffs or customs. Advocates of this system hold that commerce among the nations should be as unrestricted as the trade among the various states of the Union, or among the provinces of Canada, though some think that duties should be levied, but only to obtain revenue and without regard to the effect on domestic industries. Among the advantages argued in favor of such a system are that it is the method of nature, by which every individual has a right to buy in the cheapest market and sell in the dearest, and that attempts to check this right result sooner or later in an artificial commercial condition and cause financial disaster. It is held that the right of property implies freedom for every one to do the best he can with his own, so long as he does not infringe on the rights of others, and that protection benefits only a minority of a nation at the expense of a great majority. As to protecting infant industries, it is held by free traders that long experience has demonstrated that individuals benefited by a tariff system continue to advocate taxation for their personal gain, and that the institutions meant to be matured after years of paternal assistance never reach maturity. In 1846 Great Britain made a step toward free trade by opening the ports to the unlimited and untaxed admission of grain, and since then has gradually extended the free list until the commercial policy is practically one of free trade.

No great political party of the United States has yet advocated an absolute system of free trade. The free list has been enlarged greatly by placing on it commodities and raw materials not produced within the country, largely through the advocacy of a policy of *tariffs for revenue* only, thereby making the object rather one of collecting revenue than for the limitation or prohibition of imports. The principle of free trade is in direct opposition to a system of stimulating industry by *bounties* or limiting importation by so-called *protection* or a protective tariff system. It is claimed on one hand that nations like England, consuming more of the principal products than they produce, thrive under a system of free trade, while, on the other hand, the countries producing largely the food and apparel products can be benefited best by a partial free list and limited tariffs, though local conditions largely tend to modify or restrict the particular legislation which is most essential to the common weal. In this respect the experience of Germany, where high tariff rates are maintained, furnishes numerous examples.

FREE WILL, the power to choose between two courses of conduct without external compulsion. The freedom of the will has long been a subject for discussion in theology and psychology. This controversy hinges upon the question whether the will is free to choose, or whether it is limited by various circumstances that make free choice impossible. Those who think the will is not free to act believe that it is influenced beyond control by various conditions and circumstances, that it acts in accordance with the natural law, that it is governed by previous activity and experience, and that these, acting separately or in unison, make free choice between alternatives impossible. On the other hand, it is argued that the will enables man to select for himself his own course of action and put forth force or effort for the execution of the course he has chosen. However, it is necessary to make choices and put forth effort in accordance with the fixed laws of nature. Only when man is conscious that he makes a free choice and acts accordingly, it is possible for him to feel responsible for his actions. According to this view, he may be prevented from executing his volitions by human interference, but in the matter of making the choice he is not subject to limitation.

FREEWILL BAPTISTS, a denomination of evangelical Christians founded by Benjamin Randall (1749-1808). He was a member of the Baptist church in South Burwick, Me., but began to differ from that denomination soon after entering the ministry. In 1780 he founded a new church at New Durham, N. H. The distinctive tenets of the Freewill Baptists are the doctrines of *free salvation* and *open communion,* as opposed to those of *election* and *closed communion.* This denomination is represented by organizations in Canada and the United States and has about 100,000 members. It is strongest in New England. Bates College at Lewiston, Me., is one of its many educational institutions. It has about 1,600 churches and promotes missionary work through Sunday schools and numerous missions

FREEZING (frēz'ĭng), the changing of a liquid into a solid under the influence of cold. A large body of water cannot be cooled below the temperature of 32° Fahr., since, when brought to that condition, the entire mass changes to ice. During the change from water to ice heat is liberated from the water, the amount being correspondingly greater than any other substance liberates in cooling. Consequently, an equal amount of heat disappears when ice is changed into water. All liquids solidify at a given temperature, known as the *freezing point,* which differs in the different liquids. Thus, water solidifies at 32°; mercury at —39°; sulphuric acid, at —40°; and alcohol, at —203°. The terms *melting point* and *point of fusion* are used interchangeably with the term *freezing point.*

Advantage is taken of the cooling produced by the solution of solids to obtain low temperatures, and freezing mixtures are made by combining solids, or liquids and solids, which, when mixed, dissolve and cause a reduction of temperature. A simple mixture of this kind

consists of 33 parts of common salt and 100 parts of snow, with which a temperature as low as —5.8 Fahr. can be obtained. The most powerful mixture known, which will make alcohol of the consistency of oil or melted wax, is made by dissolving solid carbonic acid, or solid nitrous oxide gas, in sulphuric ether, giving a temperature of —120° to —200° Fahr. When matter passes from a liquid to a gaseous state, heat is again liberated, the degree of cold varying with the rapidity and extent of evaporation. See **Ice.**

FREIBERG (frī'bĕrg), a city of Germany, in the kingdom of Saxony, 35 miles southwest of Dresden. It is situated on the northern slope of the Erzgebirge, and is surrounded by a productive mining country. Commerce is facilitated by important railway and electric railroad lines. The manufactures include woolens, leather, fertilizers, machinery, and clothing. In the districts adjacent to the city are numerous smelters, which utilize the silver, lead, and copper mined in the vicinity. Freiberg is the seat of a gymnasium, a celebrated mining academy, and chemical and assay laboratories. It has a fine Gothic cathedral constructed in 1490, and contains the castle of Freudenstein. Gas and electric lighting, stone and asphalt paving, sewerage, waterworks, and a public library are among the municipal improvements. The city was made a part of Saxony in 1485. Population, 1920, 36,237.

FREIBURG (frī'bŏŏrg), a city of Baden, Germany, on the Dreisam River, 32 miles northeast of Basel. It has several beautiful specimens of Gothic architecture, the most important being the Gothic cathedral, which is built of red sandstone and rivals the noted Minster of Strassburg. This edifice has a tower 380 feet high and is remarkable for lightness and elegance. It was begun in 1122 and completed in 1513. It is the seat of the University of Freiburg, founded in 1457 by the Archduke Albert of Austria. This institution has 1,500 students and a library of 275,000. Other noteworthy buildings include the Ludwigskirche, the Rathaus, the Merchants' Hall, the grand ducal palace, and several theaters and museums. It has manufactures of clothing, potash, tobacco, paper, chicory, textiles, and machinery. Several railroads and electric car lines furnish ample means of communication, while many modern municipal facilities abound, such as telephones and electric lights. Freiburg was founded in 1090 and became a free city in 1120. It has belonged to Baden since 1806. Population, 1920, 83,328.

FREIGHT (frāt), the general name of merchandise in the process of transportation, either on ships or on railway cars. Originally the term was applied to the cargo carried by a vessel, and later it came to be used to designate the price paid to the charterer of a ship for the carriage of goods. Now it is used to describe the goods carried on land as well as on water. The conditions of carriage are usually set forth in a bill of lading, which is issued by the party receiving the freight to the shipper, and is evidence that the goods were received in the proper condition for carriage and delivery at some particular place. See **Carrier.**

FREILIGRATH (frī'lĭg-rät), **Ferdinand,** poet, born at Detmold, Germany, June 17, 1810; died March 18, 1876. He was apprenticed to a grocer, but continued his studies, and began to contribute to local journals. In 1844 he published a work entitled "Confession of Faith," in which he set forth republican ideas, which caused him to be prosecuted and flee to England. He took part in the Revolution of 1848, and was again compelled to leave the country. While in England he became familiar with the writings of Scott, Longfellow, and Shakespeare, and made a number of translations into the German. Among his writings are "New Political and Social Poems," "English Poetry of Recent Times," and "The Revolution." He is the author of numerous popular national songs, including "Hurrah, Germania" and "The Trumpet of Gravelotte."

FRELINGHUYSEN (frē'lĭng-hī-zĕn), **Frederick,** lawyer and soldier, born in Somerset County, N. J., April 13, 1753; died April 13, 1804. He graduated at Princeton in 1870 and entered the practice of law. In 1775 he was a member of Congress and was elected to several succeeding congresses. In the Revolutionary War he rose to the rank of colonel and was afterward promoted to be a major general. In 1793-96 he served as a United States Senator. He had command of the New Jersey militia during the Whisky Insurrection in 1794.

FRELINGHUYSEN, Frederick Theodore, public man, born at Millstone, N. J., Aug. 4, 1817; died May 20, 1885. He was graduated at Rutgers College in 1836, studied law, and began to practice at Newark. In 1849 he became attorney for that city and established a wide reputation as a corporation lawyer. In 1861 he took part in the peace congress at Washington, served as attorney-general of New Jersey in 1861-66, and in the latter year became United States Senator as a Republican. He was prominent in the impeachment proceedings against President Johnson and in 1870 was appointed minister to England, but declined. The following year he was again elected to the United States Senate. He was a member of the electoral commission in the Hayes-Tilden contest. President Arthur made him Secretary of State in 1881 as successor to James G. Blaine.

FREMONT (frē-mŏnt'), a city in Ohio, county seat of Sandusky County, on the Sandusky River, thirty miles southeast of Toledo. It is on several interstate automobile highways, the New York Central, and other railroads, and has transportation facilities by elec-

tric railways and by navigation on the Sandusky River, being at the head of river navigation. Among the chief buildings are the county courthouse, the Birchard public library, and the high school. It is the seat of a normal and business college, and has city waterworks and gas and electric lights. The manufactures include flour, boilers, butter and cheese, woolen fabrics, machinery, and engines. It was a trading post as early as 1785 and became Fort Stephenson in 1812. The name was changed to Fremont in 1850, in honor of General Fremont. Population, 1900, 8,439; in 1920, 12,468.

FREMONT, a city in Nebraska, county seat of Dodge County, on the Platte River, 35 miles west of Omaha. It is on the Union Pacific, the Chicago and Northwestern, and the Burlington railroads. The surrounding country is fertile and produces cereals and domestic animals. Among the chief buildings are the Midland College, the courthouse, the public library, and the high school. It has sewerage, electric lighting, graded and paved streets, waterworks, and a number of parks. The manufactures include flour, cigars, woolen goods, ironware, cured meat, machinery, and dairy products. It was settled in 1857 and incorporated in 1871. Population, 1920, 9,605.

FRÉMONT, John Charles, explorer and general, born in Savannah, Ga., Jan. 21, 1813; died July 13, 1890. He graduated at Charleston College in 1830, received an appointment as teacher of mathematics in the navy three years later, and in 1839 was commissioned as lieutenant in the corps of topographical engineers. In 1842 he conducted an extensive geographical survey between the Missouri River and the Pacific Ocean. He was brevetted captain in 1844, explored the great western basin in 1845, including portions of Utah and Nevada, and discovered a pass to the Pacific, which led to the acquisition of California by the United States. Soon after he was court-martialed on a charge of disobedience to superior military officers and found guilty, but the penalty was remitted by President Polk, though a part of the sentence was sustained, which caused Frémont to resign his commission.

JOHN C. FRÉMONT.

In 1848 he organized an expedition to explore the mountains of California, reaching Sacramento in the spring of 1849, and secured a fine tract of valuable mineral land. He was United States Senator from California in 1850-51. In 1855 he removed to New York City, and became the first candidate of the Republican party for President in 1856. When the Civil War began, he was made major general and given command of the western department with headquarters at Saint Louis. Stonewall Jackson outgeneraled Frémont in his campaign, which caused his transfer to Virginia, but this led him to resign and he took no further active part in the war. In 1878-81 he was Governor of Arizona, later practiced law in New York, and at various times was connected with Southern railroad enterprises. In 1841 he married the daughter of Senator Thomas H. Benton of Missouri. Congress placed him on the retired list of the army with the rank of major general in 1890. His services were of inestimable value to the United States, while foreign countries regarded him a benefactor of mankind, a gold medal from the King of Prussia being among the many marks of recognition. He is popularly spoken of as "Pathfinder of the Rocky Mountains." Among his published works are "Memoirs of My Life," "Frémont's Explorations," and "Reports of Exploring Expeditions to the Rocky Mountains."

FRENCH, Alice, novelist, born in Andover, Mass, March 19, 1850. She is better known as Octave Thanet, which is the name she signed to a large number of her writings. Her literary work began in 1878, when she published articles relating to economics and social methods, and later turned attention to short stories of a realistic nature. For some time she resided in Iowa and Arkansas, which afforded opportunities for studying western life and scenes, and she covered a field and touched upon places of interest before unknown in literature. Her numerous works include "Stories of a Western Town," "Knitters in the Sun," "A Book of True Lovers," "The Mortgage on Jeffy," "Otto the Knight," "Adventures in Photography," and "The Bishop's Vagabond."

FRENCH, Daniel Chester, sculptor, born in Exeter, N. H., April 20, 1850; died in 1912. His father removed to Concord, Mass., in 1867, and gave him the advantage of studying in the Massachusetts Institute of Technology. He opened a studio in Washington, D. C., in 1876, and shortly after visited Europe to study art in Paris and Florence. The earliest of his important works is "The Minute Man of Concord," which he made for the town of Concord, and his group entitled "Peace and War," in Saint Louis, Mo., is a fine production. His relief, "Death of the Sculptor," was exhibited in 1893 at the Columbian Exposition in Chicago, and several of his later productions were at the Louisiana Purchase Exposition. Other productions include "History," "Herodotus" and statues of Rufus Choate, Lewis Cass, General Grant, and Governor Chase of Michigan.

FRENCH, Sir John Denton Pinkstone, noted general, born at Ripple Vale, England,

Sept. 28, 1852. He joined the royal navy in 1866, serving until 1874, when he entered the army. He saw much active service in the Sudan and in South Africa, where, in 1900, he commanded the relief operations at Kimberly and conducted the capture of Pretoria. In 1914 he received the high command of the British armies in France, where he distinguished himself as a commander. He died May 22, 1925.

FRENCH AND INDIAN WARS, the name usually applied to four wars between the French and the English in America. They occurred in the period of exploration and settlement, in the 17th and 18th centuries, and were due in part to conflicting claims in America and partly to divergent interests in Europe. The French had settled chiefly on the Saint Lawrence and Mississippi, and based their claims upon the theory that a settlement at the source of a river gave title to all the basin, while the English held the view that settlement on the Atlantic coast extended their right across the continent to the Pacific. Migration, induced by an expansion of the colonies toward the west, caused the rival claimants to build forts on the frontier, which soon brought on active hostilities.

1. *King William's War,* the first of this series, began in 1689, when William and Mary ascended the throne of England. War was declared between England and France and at once spread to the colonies. Governor Frontenac of Canada, in 1690, sent three expeditions against the English frontiers. These expeditions included many Indians, who killed and scalped a large number of the settlers. Sir William Phipps was sent with a fleet and 1,800 men against Acadia and Port Royal, both of which he captured, but they were retaken by the French in 1691. In 1696 the French took possession of Newfoundland and captured Andover and other points in Massachusetts, but the Treaty of Ryswick, in 1697, ended the war.

2. *Queen Anne's War* began in 1702, when the War of the Spanish Succession commenced in Europe. James Moore of South Carolina, with a force of whites and Indians, destroyed several Spanish settlements in Florida. The French made an attack upon Charlestown in 1706, but were repulsed. A body of Canadians and Indians obtained possession of many points in New England and punished the English severely at Deerfield, and Haverhill, Mass. Three expeditions were sent by the English into Acadia, and the last of these, in 1710, proved successful. In 1713 the war was ended by the Treaty of Utrecht, which ceded Acadia, Newfoundland, and the Hudson Bay territory to England.

3. *King George's War* began in 1744, when the War of the Austrian Succession commenced in Europe. An attack was made by the French upon the northeastern settlement and privateers from Louisbourg, in Cape Breton, harassed the coast of New England. William Pepperell of Maine was sent with a force against Louisbourg, which was captured on June 17, 1745, after a siege of two months. Another expedition was organized against Quebec, but the Treaty of Aix-la-Chapelle terminated the war in 1748. By the terms of this treaty Louisbourg was restored to France, and the territorial conditions remained as they were before the war.

4. The *French and Indian War* was the American phase of the Seven Years' War, and was the final struggle between France and England for the possession of North America. France claimed the region west of the Alleghenies as part of the basins of the Mississippi and the Saint Lawrence, and had about 80,000 whites and the friendship of many Indians. The English had about 1,100,000 white colonists, but their people were divided into thirteen discordant governments. George Washington with a force of Virginian volunteers made an attack upon Great Meadows and was soon after compelled to surrender at Fort Necessity, a strategic point erected to defend the western frontier. In 1755 the English sent an expedition under Braddock against Fort Duquesne (Pittsburg), but they were attacked and completely routed. Other expeditions were made by way of Champlain and Fort Niagara with the view of capturing the French posts near Nova Scotia, but these proved unsuccessful. The English were defeated in all their projects until William Pitt became the head of the ministry in England, in 1757, when a general scheme was formed to conquer America. The following year Wolfe and Amherst captured Louisbourg, Forbes reduced Fort Duquesne, and Bradstreet captured Fort Frontenac. Ticonderoga and Crown Point were captured by Amherst in 1759 and Niagara was taken by Prideaux in the same year. General Wolfe captured Quebec as a result of the Battle upon the Plains of Abraham, in the same year, and the following year Montreal fell, thus completing the conquest of Canada. By the Treaty of Paris, in 1763, France ceded all lands east of the Mississippi to England, and all the lands west of the Mississippi were ceded to Spain, while Spain ceded Florida to England. This war enforced the necessity of union upon the colonists and left Spain as the only rival of England in America.

FRENCH BEAN, a twining annual plant with alternate leaves, whitish flowers, and seeds more or less kidney-shaped. Several species are cultivated, the most common being the *Lima bean.* They are native to the East Indies, whence they were brought to Europe by the French, but are now grown very extensively in all countries.

FRENCH BROAD, a river of the United States, rises in Transylvania County, North Carolina, and flows through that State and

Tennessee. It joins the Holston River four miles above Knoxville, after a course of about 200 miles. The country through which it passes is famed for its scenery, especially from Asheville to the Tennessee border, where many deep and beautiful gorges characterize the banks, some of which are 300 feet high.

FRENCH CONGO (kŏn'gō), a large colonial possession of France in West Africa, bounded on the north by Wadai; east and south by Egyptian Sudan and the Congo Free State; and west by the Atlantic, Kamerun (Cameroon), and Nigeria. It extends north to Lake Tchad and is separated from the Congo Free State largely by the Congo, the Uvangi, and the Welle rivers. The area is estimated at 590,000 square miles. A number of bays and many lagoons diversify the coast. The southeastern part is in the valley of the Congo, which is fertile and well timbered. Among the principal rivers are the Gabun, Sanga, and Ogowai. Although the country is valuable for its minerals and fertility of soil, the climate is unhealthful.

The native inhabitants are chiefly savage, engaging in hunting, fishing, and rude forms of agriculture. Among the exports are caoutchouc, ebony, palm kernels, coffee, redwood, ivory, palm oil, elephants' teeth, and drum opal. The French title to this possession is based on the explorations of M. de Brazza. He obtained concessions from the natives and occupied Gabun, a region along the coast which is now included with the colony. The country possesses valuable timber, fertile soil, and is susceptible to material development. Libreville, on the Gulf of Guinea, is the capital, whence the colonial government is administered under the direction of France. Other cities are Mayumba, Baraka, Lambarene, Brazzaville, and Franceville. Population, 1922, 12,480,000.

FRENCH GUIANA (gē-ă'nă). See Guiana.

FRENCH GUINEA (gĭn'ē), a colonial possession of France, on the western coast of Africa, between Sierra Leone and Portuguese Guinea. It extends inland to Senegal and the French territory in the Sudan. The area is about 106,200 square miles. It is largely a mountainous country, but has a favorable climate and valuable forests. The drainage is partly by the Niger and partly toward the west by the Grande. Among the chief productions are live stock, cereals, ivory, palm oil, India rubber gum, and sesame. The region was explored by the Portuguese at an early date, but the French have carried on a trade since 1685 and took possession of the country in 1869. It was made a separate colony in 1890. Konakry, on the island of Tombo, is the capital and chief port. It is connected with the mainland by a bridge. The estimated population, in 1922, was 1,860,500.

FRENCH INDO-CHINA. See **Indo-China.**

FRENCH LANGUAGE. See **France.**

FRENCH REVOLUTION, the political and military contest of France which overthrew the old feudal *régime* and the Bourbon monarchy. It began in 1789 with the meeting of the States-General and ended in 1799 with the establishment of the consulate, of which Napoleon Bonaparte was proclaimed consul for life in 1802. Previous to the Revolution, France was disturbed by a great spirit of unrest, which was intensified by the success of the American Revolution and the weakness of Louis XVI. The distress of the people had increased rapidly and the state of the finances became more desperate. Prominent men and women, who discussed political abuses and their remedies with dangerous fluency, crowded the royal palace and the salons of Paris. The government finally yielded to a general clamor for the reassembling of the States-General, and the election of members for the states took place with indescribable tumult. Meanwhile Paris was flooded with pamphlets upon the absorbing theme, and when the States-General met at Versailles on May 5, 1789, it ended the monarchy and was the immediate cause of the Revolution.

Great pomp was displayed when the States-General convened and much was expected from that body. It first undertook to settle the question of method in voting, which had formerly been by class instead of by poll. Under this plan the clergy and nobles, acting together, had a decided advantage over the third estate, or the commons. Five weeks were spent in useless parleys, when the commons decided to be the national assembly, and proceeded to deliberate upon the affairs of the state without reference to the other bodies. Louis XVI. now suspended the meetings and convened a royal sitting, at which he ordered the members of the States-General to assemble in their respective rooms. The clergy and nobles obeyed, but the commons refused to have the Assembly dissolved and through Mirabeau declared: "We are here by the will of the people, and nothing but the bayonet shall drive us hence." This signaled the loss of the royal authority, and the clergy and nobles joined the third estate.

The royal authority having failed, no resource but submission or the bayonet was open to the king. The first wave of intense excitement passed over the country on July 12, when it was reported that Necker had been dismissed and troops were rapidly collecting at Versailles. Two days later the Bastille was stormed by an immense crowd, and many of the prisoners were murdered and their bleeding heads were borne on pikes along the streets. It was the first scene in the tragedy of the Revolution. Soon after the Assembly abol-

ished all feudal rights and privileges and adopted a Declaration of the Rights of Man, which outlined the leading principles of a limited monarchy based upon a constitution. This was followed by the organization of the National Guard, but the Commune of Paris was fast getting control of the Revolution. A mob of men and women made an attack upon Versailles, where the royal guards were put to death, and the king and queen were required to return to Paris.

Although the king had taken an oath to support the new constitution, his sincerity was under suspicion, since concerted efforts were made by the émigrés (q. v.) to secure assistance from foreign powers as a means to end the Revolution. The king and queen escaped from Paris in 1791, but were arrested at Varennes, about seventy miles from Paris, and were forced to return. In 1791 the National Assembly had declared its members ineligible to reëlection, which body was now succeeded by the Legislative Assembly. This body was made up of three powerful factions; the Girondists, who were republican; the Feuillants, who supported the constitution; and the Mountain, a party that was made up largely of demagogues and anarchists. Louis unwisely dismissed the Feuillant ministry and appointed a Girondist cabinet, and war was soon after declared against the empire by Prussia and Austria.

The campaign against foreign enemies proved a failure, causing the breach between the king and the Assembly to widen. He soon dismissed the Girondist ministry and sought an alliance with friendly princes, but the Jacobins and Girondists instigated an insurrection. On June 20, 1792, a mob made an attack upon the Tuileries, but the leaders were persuaded to disperse the people. The second attack upon the Tuileries took place on Aug. 10, which was sacked and plundered by the frenzied mob. Louis threw himself upon the mercy of the Legislative Assembly, which was compelled by the mob to put him in prison and suspend him from office. On Sept. 20 the National Convention, as the next Assembly was called, met to take up the government. It included some of the most violent revolutionists, such as Danton, Marat, Camille Desmoulins, and Robespierre, and immediately abolished royalty and proclaimed the republic. The extremists finally carried a measure to confiscate the property of the nobles and priests, and promoted a policy favorable to the annexation of Belgium. A German army had previously invaded France, but was defeated by Dumouriez at Valma. Louis was accused of plotting against the liberty of the people, and after a stormy debate was declared guilty and sentenced to die. He asked for a respite of three days, but was refused and executed while the crowd shouted *Vive la Republique!* This aroused the nations of Europe and a concerted organization was affected by Holland, England, Spain, and Germany to strangle the Revolution, which threatened to overthrow the royalties and aristocracies of Europe. The Austrians defeated Dumouriez, who soon after joined the allied camp against the revolutionists.

The government now organized the Committee of Public Safety and France was thrown into the Reign of Terror. The Jacobins, under the lead of Robespierre, ordered the Girondists arrested, and those who escaped were outlawed and pursued with unrelenting vengeance. All the prisons were crowded, some of the most illustrious citizens were condemned, and the guillotine was kept at work in every part of France. Among those executed were Madame Roland, Philippe Egalité, and Queen Marie Antoinette. Lavoisier, the chemist; Bailly, the astronomer; and De Noailles, the marshal of France, were among the many illustrious persons who were hurried to the scaffold. Many churches and convents were plundered, tombs were rifled, Notre Dame was converted into a Temple of Reason, and red caps were worn to indicate that liberty had been enthroned. At length the terrorists were divided and Robespierre, who had been the most conspicuous figure among them, was beheaded on July 28, 1794. The Reign of Terror was now at an end, the Jacobin Club was disorganized, thousands of prisoners were released and the Terrorists were disarmed. Many defenders of the new republic volunteered to protect the frontiers against foreign invasions. The States-General was organized into two houses, the Council of Five Hundred and the Council of the Ancients, the former to propose and the latter to pass or reject laws. Executive power was lodged in a directory of five persons. Napoleon Bonaparte was called to defend the Tuileries. He planted cannon that swept the insurgents as they came within range of his pitiless guns, thus ending the last insurrection of the people.

FRENCH SOMALILAND (sō-mä'lē-lănd), a colonial possession of France in the northeastern part of Africa, bordering on the Gulf of Aden. It is bounded on the north by Eritrea, east by the Gulf of Aden, south by British Somaliland, and west and southwest by Abyssinia. The area is 45,000 square miles. The surface is hilly along the coast and much of the interior is an elevated plateau, ranging about 4,000 feet above sea level. Gold, coffee, ivory, and fruits are exported; and foodstuffs, machinery, tobacco, and cotton and silk textiles are imported. Jibuti, the chief port, is connected with the interior by a railway and is the seat of colonial government. A part of the possession has belonged to France since 1855, when Obok was made a French port. Subsequently the boundary was moved inland and

treaties were made with Italy, England, and Abyssinia in the period of 1887-96, definitely fixing the boundaries. The government is administered by a governor, who is assisted by a general council of six members. Galla and Danakil races constitute the larger portion of the natives. Population, 201,500.

FRENCHTOWN, a village in Michigan, the site of which is now occupied by the town of Monroe, about 22 miles southwest of Detroit. It was the scene of a battle on Jan. 14, 1813, when an American force of 650 men under Colonel Lewis defeated a force of British and Indians under Major Reynolds. A second engagement occurred at the same place on Jan. 22, 1813. The British under Colonel Proctor made an attack upon General Winchester, who now commanded at Frenchtown, and the Americans were compelled to surrender. Many of the latter were massacred by the Indians, hence the affair is sometimes called the Massacre of the Raisin River.

FRENCH WEST AFRICA, a territorial possession of France, including nearly all of the Sahara. It was made a governor generalship on Oct. 17, 1899, and in 1902 was divided into Dahomey, Ivory Coast, Senegal, French Guinea, Senegambia, and the military territory of the Niger. Government authority over all of these possessions is exercised by the governor general of French West Africa, who has his seat at Saint Louis, in Senegal.

FRENEAU (frē-nō'), **Philip,** poet, born in New York City, Jan. 2, 1752; died Dec. 18, 1832. He graduated at Princeton in 1771, where he was associated as a student with James Madison. In 1776 he made a trip to the Danish West Indies and subsequently engaged in writing poetry and prose. He made a mercantile voyage to the West Indies in 1780, when he was taken prisoner by the British, and after his release published his poem "The British Prison-ship." In 1791 he became editor of the *Daily Advertiser* and subsequently of several other newspapers. He was a strong opponent of the Federalist party and a supporter of Jefferson. His writings include "The Rising Glory of America," "The Indian Burying Ground," and "The Wild Honeysuckle." A few of his volumes were published under the pen name of Robert Slender.

FRERE (frēr), **Sir Henry Bartle Edward,** diplomat and administrator, born at Clydach, England, March 29, 1815; died May 29, 1884. He studied at the grammar school in Bath and attended Haileybury College, where he prepared himself for service in India. In 1833 he entered the civil service in Bengal, removed to Sindh in 1856, and served throughout the Sepoy mutiny. He was made governor of Bombay in 1862, serving five years, and became a member of the privy council in 1873. Subsequently he removed to Cape Colony, where he was governor from 1877 until 1880, when he was made high commissioner for British South Africa.

FRÈRE (frâr), **Pierre Édouard,** eminent painter, born in Paris, France, Jan. 10, 1819; died at Écouen, May 23, 1886. He studied in Paris under Paul Delaroche, and exhibited his first productions in 1843 at the Salon. His subjects are largely scenes from domestic life, amusements of children, and portraits, bearing marked traces of purity and grace. A number of his works were exhibited in the galleries of France, while a painting, "Preparing for Church," is in the Corcoran gallery at Washington. Among his other productions are "Boys Going From School," "Orphan's First Prayer," "Little Gourmand," "Girls Going From School," and "The Gleaner Boy."

FRESCO (frĕs'kō), the art of painting with water colors on fresh plaster, or on a wall covered with mortar not entirely dry. The most satisfactory results are obtained when the plaster is laid on as the painting proceeds, since the unhardened fresh plastered walls permit the color to sink and form a more satisfactory surface. It was highly developed as an art by the ancients, and is now generally employed for large pictures on walls and ceilings. Numerous well-preserved frescoes are to be seen in many of the temples. Splendid specimens of ancient frescoes were found in Pompeii, Egypt, India, and Mexico, though the art was not brought to the greatest perfection until the rise of the finer Italian art in the 16th century. Many of the ancient paintings were executed in what is called *fresco secca,* which is quite distinct from genuine fresco, since it is executed on dry walls and ceilings, previously moistened with limewater.

FRESNEL (frâ-nĕl'), **Augustin Jean,** physicist and inventor, born in Broglie, France, May 10, 1788; died near Paris, July 14, 1827. He was educated at Paris, became government engineer to the department of Vendée, and later was superintendent of public works in Paris. In 1814 he turned his attention to the study of the polarization of light, and added much valuable knowledge of its properties to science. His inventions include a system for lighting useful in lighthouses, which is known by his name and is used almost universally. In 1823 he was elected a member of the Academy of Science.

FRESNO (frĕz'nō), a city of California, county seat of Fresno County, about 40 miles north of Tulare Lake and 200 miles southeast of San Francisco. It is on the Southern Pacific and the Atchison, Topeka and Santa Fé railroads. The noteworthy buildings include the Carnegie public library, the Federal building, the county courthouse, and the high school. It has systems of waterworks, electric lighting, pavements and electric street railways. Among the manufactures are flour, furniture.

agricultural implements, ironware, and fruit products. The surrounding country is fruit, cereal, sheep, and mineral producing. An abundance of water power is drawn from the falls of the San Joaquin River, about 30 miles distant. Population, 1900, 12,470; in 1920, 44,616.

FREUD, Sigmund, noted psychiatrist, born at Freiburg, Moravia, May 6, 1856. He studied at Vienna, where he lectured on the diseases of the nerves. His writings are entirely in German, but have been translated very extensively. In 1909 he visited Canada and the United States. His reputation is based upon his psychoanalytical treatment of hysteria and especially upon his theory of dreams.

FREY (frī), or **Freyr,** in Scandinavian mythology, the brother of Freya and the son of Njörd, and regarded the god of pleasure and fruitfulness. He was beloved by men and all the gods, who bestowed many presents upon him. Loki gave him the ship *Skidbladnir,* which always had a fair wind and, though large enough to carry all the gods, it could be folded up and carried in the pocket. A second present from Loki was a swift boar with golden bristles, which could be used in flying through the air or over the land and sea. It is said that Frey fell in love with Gerda, the beautiful daughter of the giant Gymir, and by her was required to forfeit the sword he used in defending the gods. The people of ancient Sweden gave special attention to the worship of Frey.

FREYA (frī'ȧ), or **Freyja,** in Scandinavian mythology, the daughter of Njörd and the wife of the god Odur, for whom she continually shed tears of gold. She was credited with half the heroes who died in battle, since the love of her was a fruitful cause of wars. Her worship was similar to that of Venus among the Greeks and Romans, as she was looked upon as the goddess of love and beauty.

FREYCINET (frȧ-sē-nȧ'), **Charles Louis,** statesman, born in Foix, France, Nov. 14, 1828. He was educated at the École Polytechnique, appointed engineer of the first class in 1864, and became a member of the council in 1870. In 1878 he was elected a member of the Academy of Science and subsequently an officer of the Legion of Honor. He published several works on engineering. He died May 15, 1923.

FREYTAG (frī'tăg), **Gustav,** noted author, born in Kreuzburg, Germany, July 13, 1816; died May 1, 1895. He studied at Breslau and Berlin, and lectured on German language and literature at the former university from 1839 to 1847. In the meantime he published several editions of poetry and plays. He edited the *Grenzboten* at Leipzig in 1848-70, during a portion of which time he held a court position, and in 1879 settled in Wiesbaden. His poems, novels, and dramas are alike brilliant and realistic, a number of which have been translated into English by Mrs. Malcolm. Among the best known are "Graf Waldemar," "Debit and Credit," "The Lost Manuscript," "Our Ancestors," "Doctor Luther," "Dramatic Technics," and "The Valentine."

FRIAR, a member of a monastic brotherhood; especially one who belongs to such mendicant orders as the Dominicans, Franciscans, Carmelites, and Augustinians. The term is commonly used to distinguish members of modern religious communities in the Roman Catholic church from the older title of monk, which has special reference to the Benedictines and their branches. In reference to the clothing worn, the Dominicans were formerly called *Black Friars;* the Franciscans, *Gray Friars;* and the Carmelites, *Barred Friars.* The monks are generally called friars in Ireland.

FRICTION (frĭk'shŭn), in mechanics, the resistance arising when two or more bodies move while the surfaces are in contact. It is usually classified as *sliding* or *rolling,* the former being exemplified by the sliding of a sled or skate and the latter by the friction of the wheels of a wagon on the ground. All bodies have elevations and depressions, more or less prominent, and the projecting points of one body render movement more difficult by entering the cavities of the other. However, the intensity of friction depends to some extent upon pressure and slightly upon adhesion. Friction is greatest when a body at rest begins to move, thereby making it difficult for a force to displace the body, owing to its inertia being influenced by friction. The inertness is greatest in large and heavy bodies. Oil and other lubricants are used to lessen friction in machinery and instruments. Friction is a retarding force in nature, and gives stability to bodies which otherwise would be easily displaced. Since friction generates heat, it is one of the chief means of developing electricity.

FRIDAY (frī'dȧ), the sixth day of the week, following Thursday and preceding Saturday. It occurs on the same day as the Mohammedan Sabbath and is the day for general fasts and obligation in the Anglican, Greek, and Roman churches. Friday was named from Frigga (q. v.), a Scandinavian goddess.

FRIENDLY ISLANDS, or **Tonga Islands,** an island group in the South Pacific Ocean, about 250 miles southeast of the Fiji Islands. The islands, about 150 in number, are divided into three groups by two narrow channels and have a total area of 390 square miles. Tongatabu, having an area of 125 square miles, is the largest and contains Nukualofa, the capital. About 30 of the islands are inhabited by friendly natives. They are partly of volcanic and partly of coral origin and have a fertile soil. A number of the volcanoes are active, including Tofoa, height 2,785 feet, and Late, height 1,790 feet. Copra, sponges, coffee, wool, and tropical fruits are the chief products.

Manufacturing is in a primitive state, the products including rude machinery, pottery, and wearing apparel used by the natives. Christian missionaries began active work in 1877, since which time the Christian cause has secured many adherents, schools have been established, and a general advance has been made in moral and intellectual development. The government is directed by a native Christian chief and is administered under a constitution, which provided for a representative parliament and a well-established judiciary. European customs, education, machinery, and utensils have been introduced to a large extent. The island group was discovered in 1643 by Tasman. It was visited in 1777 by Captain Cook, who applied the present name. The islands were declared neutral by the Declaration of Berlin in 1886, but Germany, Great Britain, and the United States held special treaties. In 1899, with the assent of Germany and the United States, Great Britain proclaimed a protectorate. Population, 1922, 21,661.

FRIENDS, Society of. See **Quakers.**

FRIGATE (frĭg'ăt), a name applied originally to a class of long vessels common in the Mediterranean, navigated with sails and oars. It is now used to designate warships that have a high speed and great fighting power. Many of the largest men-of-war belong to this class and carry from twenty to forty guns, sometimes more than that number.

FRIGATE BIRD, a tropical web-footed bird, related to the pelican and sometimes called frigate pelican and man-of-war bird. It is so named from its fierce attack upon other birds, especially when they are carrying articles of food. The bill is longer than the head, the tail has twelve large feathers and is forked, and the extent of wing is about seven feet. Birds of this kind have great power of flight and are frequently seen a thousand miles from land. They often fly in flocks so high that they are scarcely visible, but are very awkward in moving about on the land. These birds are common to the intertropical coasts of the Atlantic and Pacific oceans, and are rarely found north of South Carolina.

FRIGGA (frĭg'gà), or **Frigg,** the highest goddess of the ancient Scandinavians. She was the daughter of Fjorgyn, the wife of Odin, and the mother of the race of celestial gods. Fulla, the favorite servant and intimate confidant of Frigga, was intrusted with the toilette and most important secrets of her mistress. The names Frigga and Freya are sometimes closely associated, but the latter corresponds to Venus. Friday, the sixth day of the week, was probably named from Frigga.

FRISIANS (frĭzh'ănz), an ancient German race that dwelt in the northwestern part of Germany, between the Rhine and the Ems. The Romans under Drusus made them tributary, but later they instigated several revolutions on account of Roman oppression. Subsequently their district was reduced to Friesland, but in the 9th century they obtained their independence, which they maintained until 1498, when their history became merged into that of Germany and Holland. They are an industrious people, have a fine literature, and include a number of eminent historians, poets, and scientists. Modern Frisian is usually divided into East and West Frisian, but both branches have been influenced very largely by the German, especially by the *Platt Deutsch.*

FRITH (frĭth), **William Howell,** painter, born near Ripon, England, Jan. 9, 1819. He studied art in Bloomsbury and at the Royal Academy and began to exhibit in 1840. He was made a member of the Royal Academy in 1852. His "Before Dinner at Boswell's Lodgings in Bond Street," exhibited in 1866, sold for $22,500. Among his works are a number of engravings. Queen Victoria purchased his "Life at the Seaside, Ramsgate," which represents a large gathering on a holiday. Other paintings include "The Village Pastor," "Derby Day," "Marriage of the Prince of Wales," "Railway Station," "The Road to Ruin," and "The Private View of the Royal Academy." He died Nov. 2, 1909.

FROBISHER (frŏb'ĭsh-ẽr), **Sir Martin,** famous seaman in the time of Elizabeth, born in Yorkshire, England, about 1535; died in Plymouth, Nov. 7, 1594. He went to sea when a boy, became skilled as a navigator, and was the first Englishman to attempt the discovery of a northwest passage to China. After attaining skill as a navigator, he made three expeditions to Labrador and the Arctic regions for the purpose of finding a passage to India by the northwest, and attempted to found settlements in the region bordering on Hudson Bay. In 1585 he had command of a vessel under Sir Francis Drake in his famous expedition to the West Indies. He commanded squadrons against the Spanish Armada in 1590, capturing numerous ships, and afterward plundered the Spanish vessels sailing to America. In 1594 he assisted Henry IV. of France, taking part in the siege of Crozon, near Brest, where he was mortally wounded and died in Plymouth soon after.

FROBISHER BAY, an inlet on the southeastern coast of Baffin Land, about 20 miles wide and 200 miles long, and marked by precipitous, rocky shores. It is located about midway between Hudson Strait and Cumberland Sound, west of the southern point of Greenland, and at its entrance is Resolution Island. The fisheries are valuable, but the catching season is short on account of extremely cold winters.

FROEBEL (frē'bęl), **Frederick Wilhelm August,** celebrated reformer and educator, born in Oberweissbach, a village of the Thuringian Forest, Germany, April 21, 1782; died in Marienthal, June 21, 1852. His mother died shortly after his birth and his education devolved upon

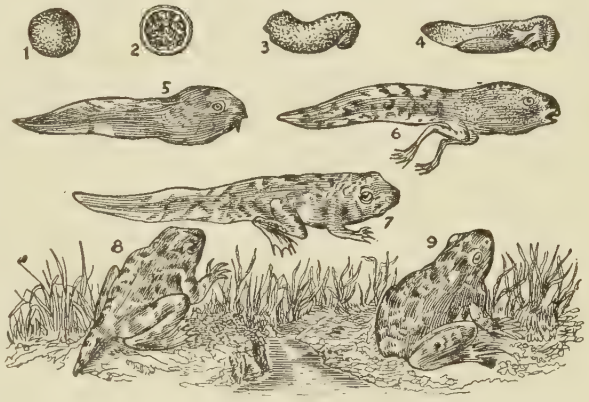
his father and uncle, both village pastors. Left largely to himself in the Thurginian Forest, he developed a marked insight into the essential unity of nature's laws by a profound interest in nature studies. After securing a rudimentary education and taking a course in higher work, he engaged partly in teaching and partly in more especially fitting himself for the lofty calling of teaching. Beginning in 1807, he studied at the celebrated institution of Pestalozzi at Yverdon, near Neuchâtel, where he remained two years for the purpose of qualifying himself in exemplifying the educational principles deduced from the instruction of that master teacher. In 1811 he studied in Göttingen and later in Berlin, and in 1813 enlisted in the army. After the Peace of Fontainebleau, in 1814, he returned to Berlin, where he became curator of the museum of mineralogy. Soon after he established a school at Keilhau, where he was assisted by Yangethal and Middendorff in carrying out his advanced views in educational science. Soon after he wrote "Treatise on the Theory of Teaching" and organized a branch school.

FREDERICK W. A. FROEBEL.

Froebel early recognized the need of trained teachers and began to instruct assistants for the primary work. In 1836 he founded his *Kindergarten,* or "Garden of Children," at Blankenburg, a system of education which has since spread to all civilized nations. The kindergarten system of training beginners as instituted by Froebel is generally popular in Austria, has a widespread foothold in Germany, Italy, Switzerland, and the Netherlands, and is meeting with growing favor in America. Besides his advanced theories for teaching young children in following the course of nature and leading them to grow and expand in accord with natural laws, he influenced the higher education perceptibly, both in theory and application. Among his published works are "Education of Man," "Treatise on Sphericity," "Pedagogics of the Kindergarten," and "Songs for Children." He edited *The Weekly for All Friends of Culture.*

FROG, a tailless amphibian animal which belongs to the leaping *Batrachians.* It has four legs, a flat head, a rounded nose, a very large mouth, and teeth on the upper jaw and palate. The hind legs are very long and stout and the feet are webbed. On the hind feet are five toes, while the front feet have only four. The tongue is thick and fastened in front to the lower jaw so the back part may be thrown out of the mouth very quickly, thus enabling it to catch insects, bugs, and various other forms of life on which it feeds. It swims by means of its hind legs and lives much of the time in the water. However, an adult frog cannot live wholly in the water, having lungs, thus being required to come to the surface at intervals to breathe. In winter it lies burrowed in the mud, and its harsh *croak* may be heard in spring as soon as the sun has loosened the frost.

The female frog lays from 600 to 1,200 eggs, usually in March or April, which consist of a gelatinous mass with minute, black globules. By the end of April they have enlarged and hatched, the young being known as *tadpoles.* The tadpoles breathe by means of gills and have a tail, swimming about like small fish. Their hind legs appear first, later the fore legs, after which they remain dormant and the tail is absorbed, when they are said to "live on their tail." Soon after they quit the water and begin to breathe by lungs instead of gills. The process of breathing is carried on by the action of the muscles of the throat and abdomen.



METAMORPHOSIS OF THE FROG.

1, egg; 2, egg partly incubated; 3, newly hatched tadpole; 4, tadpole with gills; 5, outside gills replaced by internal ones; 6, tadpole with hind limbs; 7, tadpole with four limbs; 8, tadpole with rudimental tail; 9, adult frog.

All species of frogs are destitute of ribs. They make a loud, croaking sound, especially the bullfrog of North America, which grows to a length of fifteen to twenty inches. While frogs are usually green in color, they often have stripes or spots of dark-brown on the back, and the throat is yellow. The eggs of the frogs, like those of fishes, are fertilized after they are laid. Many people consider the hind legs of the American bullfrog excellent food. Several species known as wood frogs live in timber districts, frequenting the trunks and limbs of trees in search of food.

FROHMAN, Charles, theatrical manager, born at Sandusky, O., June 17, 1860; drowned May 7, 1915. He studied in New York City, where he was employed in a newspaper office, and for some time sold tickets at Hooley's Theater, Brooklyn. In 1877 he took charge of a company and traveled in the western states, and for some time was with Haverly's Mastodon Minstrels in America and Europe. He bought rights to play "Shenandoah," with which he made a great financial success. In 1890 he organized the Charles Frohman Stock Company and became proprietor and manager of Madison Square, the Empire Theater, and other theaters of New York City, and conducted the Duke of York Theater in London. He brought out John Drew, Maude Adams, Julia Marlowe, and other well-known star actors.

FROISSART (frois'ärt), **Jean,** poet and historian, born in Valenciennes, France, in 1337; died in Chimay about 1410. The personal history of Froissart is known only from the incidents detailed in his verses and the "Chronicles." It appears that he received a liberal education and was trained for the church, but possessed a passion for poetry and the charms of knightly society. He commenced a history of the wars of his period at the age of twenty. To secure data he traveled to examine the places at which historic battles occurred, that he might detail accurately the events. His line of travel was through France, Great Britain, Germany, Switzerland, Italy, and Spain. The writings based on his travels furnish valuable information regarding the customs and habits of the people and of the more important events connected with the countries visited en route. He made a second visit to England in 1361-66, when he became secretary to the queen, and later was entertained by King David Bruce. His "Chronicles" was edited in his native town, but he returned to England after a lapse of forty years to study newer developments, and again returned home to complete his descriptions by revising and editing. It is certain that he was an interesting story teller, resourceful in securing information and accurate in detailing events. On account of his wit, shrewd observance, and gay poetry he was everywhere honored and welcomed. His "Chronicles" is a valuable work for illustrating the character and manner of his age, and embraces the events occurring from 1326 to 1400. It has been translated into Latin and numerous modern languages. The original manuscript is in the library at Breslau, Germany.

FRONDE (frônd), the name of a political faction in France which headed an insurrectionary movement during the latter part of the minority of Louis XIV. It was so named from *frondeurs,* meaning slingers, since their attacks upon Cardinal Mazarin were said to resemble the act of boys throwing stones with slings. The movement started in 1648, when the Parliament refused to register certain objectionable royal edicts that followed the breaking up of the feudal system, and, when the king compelled that body to register, the people rose in defense of their rights. The struggle continued until 1652, by which time the nobles had won great constitutional reforms, but they had no definite object except selfish profit and were not directed by a strong leader, hence Mazarin regained his former power. As a whole, the War of the Fronde may be classed as a useless political and military contest, since the loss of advantages that had been gained temporarily contributed to make Louis XIV. an absolute monarch.

FRONTENAC (frŏnt'tĕ-năc), **Louis de Buade,** soldier, born in France about 1622; died Nov. 28, 1698. He entered the military service of France at an early age and took part in active operations in Flanders, Italy, and Germany. Louis XIV. appointed him governor of New France in 1672, as successor to De Courcelles. He built Fort Frontenac, now Kingston, Ont., and sent out the famous expeditions under Joliet, La Salle, and Marquette. In 1682 he was recalled, owing to the opposition of Bishop Laval of Quebec, but was again made governor of Canada in 1689. Shortly after he defeated the Iroquois, destroyed the English fleet in Hudson's Bay, and captured a number of English points in Newfoundland and New England. In 1690, during King William's War, he defeated the English forces before Quebec. Soon after the close of that war he conducted a campaign in the Mohawk country, and in 1696 compelled the Iroquois to sue for peace.

FROST (frŏst), the minute crystals of ice formed directly from the vapor of water. At a temperature of 32° Fahr. the watery vapor becomes so cold that it cannot condense into water, but falls to the earth in the shape of frost instead of dew. This is known as *white* or *hoar frost.* The name is often applied to moisture hardened by cold after it has fallen in the form of dew, or to the inside of window panes in a warm room. Frost is very destructive to plants, as the water in the juices expands when it freezes and thereby bursts the vesicles. Clouds and smoke act as a covering to check radiation. Winds bring fresh masses of air into contact with the cold objects and prevent frost, which accounts for dew and frost falling most abundantly at night when there is little movement in the atmosphere. *Black frost* is caused by cold so severe that plants freeze and change color without showing any signs of hoar frost. A *frostbite* is a state of numbness of any part of the body of an animal, but especially of the extremities, by exposure to extreme cold. In like manner plants partially frosted are said to be frost-bitten. Slight frostbites in animals often cause chil-

blains, which are annoying but not very dangerous, but in severe cases gangrene may set in or they may result in permanent injury or even death. Rubbing and applications of snow or cold water are recommended as soon as the injury is discovered.

FROSTBURG (frôst'bûrg), a town of Maryland, in Allegheny County, in the western part of the State, on the Cumberland and Pennsylvania Railroad. The location is on a fine plateau between Dan's and the Savage mountains, about 2,150 feet above the sea, and the surrounding country has extensive coal mines and deposits of fire clay. It is the seat of a State normal school. The manufactures include brick, machinery, clothing, and cigars. Frostburg is popular as a summer resort. Population, 1900, 5,274; in 1920, 6,017.

FROUDE (frōōd), **James Anthony,** historian, born in Dartington, England, Jan. 23, 1818; died Oct. 20, 1894. He studied at Westminster and Oxford and in 1842 was elected as fellow of Exeter College. In 1844 he took deacon's orders, but soon after engaged in literary work by contributing to magazines. He was elected rector of Saint Andrews University in 1869, where he received an honorary degree. In 1874-75 he visited the South African colonies in the interests of the British government, and published a number of reports relative to that section of the world. He possessed a degree of ability that gave his history the fascination of fiction and displayed a supreme literary power, but his historical works are largely impaired by distorted views and unfairness in giving tone to the motives of other nations and peoples. As a versatile and prolific writer he is rivaled only by Macaulay, though his works do not possess the fairness with which that writer treated non-British institutions. Among his most important productions are "Shadows and Clouds," "History of England from the Life of Woolsey to the Defeat of the Spanish Armada," "Short Stories on Great Subjects," "Two Lectures on South Africa," "Life of Lord Beaconsfield," "Life and Letters of Erasmus," "Divorce of Catharine of Aragon," and "The English in Ireland in the Eighteenth Century."

FRUIT (frut), in botany, a mature ovary of a plant, which contains the seeds, especially such plant products as are pleasant to the taste and eaten by man and animals. Other parts of the flower, most frequently the calyx, sometimes remain after the flowering is over, undergo a further development, and form part of the fruit. All that is external to the seed in ripe fruit is called the *pericarp* and is the edible portion, except in such berries as grapes, gooseberries, and others, whose pulpy matter is formed from the placentas of the seeds. The value of fruit to man exceeds that of all other parts of plants. Among the more important fruits in the temperate climates are apples, peaches, plums, cherries, melons, apricots, mulberries, strawberries, raspberries, and others, while with those of the warmer regions may be included the dates, olives, figs, grapes, oranges, bananas, nuts, etc. Fruit is grown very extensively for the market, both in Canada and the United States, although the latter country has a wider range of climate and produces a greater number of species than Canada. See **Horticulture.**

FRY, Elizabeth Gurney, philanthropist, called "The Female Howard," born in Norwich, England, May 21, 1780; died Oct. 12, 1845. She was converted by the efforts of William Savery and joined the Society of Friends. Soon after she organized a school for poor children, at which eighty attended, and in 1800 married Joseph Fry, a merchant of London. In 1813 she devoted her energy to the betterment of the female prison at Newgate, preached the gospel, and with her brother visited the prisons of Scotland in 1818 and of Ireland in 1827. The House of Commons acted upon her suggestions by establishing departments of instruction and manufacturing in the prisons and made provision for giving religious aid to convicts. She made an extended visit to France in 1838, traveled through Germany, Belgium, and Holland in 1840, and the following year visited Copenhagen. A monument was erected to her memory in London.

FRYE, William Pierce, statesman, born in Lewiston, Maine, Sept. 2, 1831. He studied at Bowdoin College, was admitted to the practice of law, and in 1861 and 1867 was elected to the State Legislature. In 1867-69 he was attorney-general of Maine, served as representative in Congress twelve years consecutively, and was appointed to fill a vacancy in the United States Senate occasioned by the resignation of J. G. Blaine, taking his seat in 1881. Subsequently he was reëlected for several consecutive terms, serving his constituents in a prominent and effective manner. In 1896 he was elected president *pro tempore* of the Senate, and in 1898 was appointed by President McKinley as one of a committee of five to negotiate a treaty of peace with Spain. He was granted degrees by Bowdoin and Bates colleges and served as a trustee of the former institution. In 1906 he was reëlected to the United States Senate for the term which expired in 1913. He died Aug. 8, 1911.

FUCA, Juan de (hōō-än' dā fōō'kā), a strait between the United States and British America, separating Vancouver Island from the State of Washington. It connects the Pacific Ocean with Puget Sound and the Strait of Georgia, the former lying south and the latter north of its eastern extremity. It is from 15 to 30 miles wide, about 100 miles long, and contains a number of islands. The Strait of Juan de Fuca was so named from Juan de Fuca, a Greek navigator, who discovered it about 1592.

FU-CHOW. See **Foochow.**

FUCHS (fo͝oks), **Leonhard,** botanist, born at Wembdingen, Germany, Jan. 17, 1501; died May 10, 1566. He studied at Ingolstadt and Tübingen and in 1526 began the practice of medicine. In 1535 he was made professor of medicine at Tübingen, where he instructed successfully until his death. His writings treat largely of botany and medicine. The fuchsia, an American plant, bears his name. He is regarded one of the founders of scientific botany.

FUCHSIA (fū′shĭ-ȧ), a genus of flowering shrubs native to Mexico, South America, and New Zealand, and so named from the discoverer, Leonard Fuchs (1501-1566), a German botanist. About seventy species have been described. The calyx is funnel-shaped and four-parted, with the four petals set alternately, the

FUCHSIA.

style is long, and the stigma is capitate. Popularly they are called *ladies' eardrops,* from the appearance of the pendulous flowers. They are favorites as house and garden plants and thrive in a light, rich soil, though growing best in a mixture of loam and peat. New plants may be developed from young cuttings set in sand or loam.

FUEL (fū′ĕl), the material with which a fire is fed, including various forms of carbonaceous matter, such as gaseous, liquid, and solid substances. The phenomenon of heat arises by combining fuel with oxygen, as by combustion, and forms an essential element for manufacturing and domestic purposes. Natural gas, common coal gas, and acetylene gas are used very extensively for heating, lighting, and manufacturing. Among the liquid fuels are alcohol, creosote, petroleum, shale oil, and various vegetable and animal oils. Each of these is employed with success for divers purposes, though petroleum and creosote constitute the principal kinds used in the large manufacturing establishments. Crude petroleum has come into extensive use on locomotives as well as steamboats. Alcohol is a valuable fuel where a small volume of heat, which can be easily regulated, is wanted for small manufacturing enterprises and in experiments. Among the solid fuels are wood, coal, peat, wood charcoal, and coke.

In pioneer settlements and countries destitute of mineral fuel, wood and its products are the principal forms used, though coal and its products constitute by far the most important fuel used in the great centers of manufacture, ocean navigation, railroad operation, and for heating purposes. The extensive natural gas deposits in America and Eurasia are having a marked influence, not only in propelling machinery, but in smelting and refining. Within recent years lighting by electricity has displaced the consumption of fuel for street illumination and largely as material for house lighting, especially in large centers of population. At the present rate at which electricity is coming into use for heating purposes, it is not improbable that some plan will be devised to displace many other forms by this inexhaustible agent.

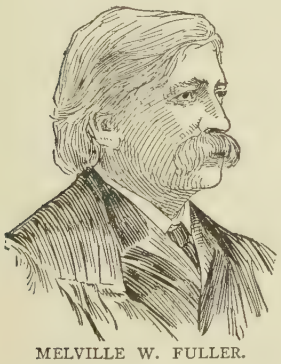
FUGITIVE SLAVE LAW (fū′jĭ-tĭv), the statutes of the United States which provided for the return of the slaves who escaped from the State in which they were held in servitude. The surrender of slaves that had escaped to another State was a matter of mere comity under the colonial government as well as under the Articles of Confederation. Though the word *slave* is not used in the Constitution of the United States, a clause in Article IV. directs that escaped slaves be returned to their masters. In 1793 the first law of Congress was passed under this provision, and it directed that escaped slaves and criminals be returned. The provision imposing on magistrates of the states certain duties under Federal statutes led to some complications, but an attempt in 1818 to amend it failed. A new and more stringent law was provided by the Compromise of 1850, under which the refusal of the marshal to execute writs under the act subjected him to

a fine. He was made liable for the value of slaves escaping from his custody, and those obstructing an arrest or attempting a rescue were made subject to a fine together with imprisonment. A commissioner who investigated and adjudged the prisoner a slave was allowed a fee of $10.00, but only $5.00 was paid to him, if the person was set free, and the testimony of the person claimed as a slave was never taken. These provisions caused a large number of free Negroes in the North to be kidnapped. Many northern states passed personal liberty laws, by which the breach preceding the Civil War was widened. The fugitive slave laws were not repealed until 1864.

FUJIYAMA (fo͞o-jĭ-yä′mä), or **Fuju-San,** the highest elevation of Japan, situated on the island of Hondo, in the province of Suruga, about 60 miles west of Tokio. Its crater is 500 feet deep. The mountain was active at numerous times prior to 1707, but since then has been dormant. It has an elevation of 12,365 feet above sea level. The Buddhists hold it sacred and wander in large companies to its higher places of interest from July to September, when the snow is melted under the more direct rays of the sun. Many shrines and temples are maintained at different elevations.

FULAH (fo͞o′lä), a race of Negroes native to Africa, found chiefly in the basin of the Senegal River, but distributed more or less widely throughout the Sudan. The color is light brown; the stature, medium; the head, long; the speech, Negroid; and the hair, wooly, but not frizzled. They give evidence of considerable shrewdness and intelligence, and are skilled in manual labor and the manufacture of native clothing and utensils. In the eastern part of the Sudan they are mixed largely with the Ethiopian races.

FULLER (fo͝ol′ẽr), **Melville Weston,** noted jurist, born in Augusta, Me., Feb. 11, 1833. In 1853 he graduated at Bowdoin, studied law at Bangor and Harvard, and was admitted to practice at the bar in 1855. He edited the Augusta *Age* for several years. Besides serving on the common council, he was city attorney. He removed to Chicago in 1856, where he practiced law successfully for more than thirty years. In 1862 he was a member of the Illinois constitutional convention, was elected to the Illinois House of Representatives the following year, and served as a delegate to all the Democratic national conventions from 1864 to 1880. President Cleveland nominated him Chief Justice of the United States Supreme Court in 1888, and he entered upon the duties of that office in October of the same year. He was one of the arbitrators in the Anglo-Venezuelan dispute in 1899. As a judge and jurist he ranks among the most distinguished of America. He died July 4, 1910.



MELVILLE W. FULLER.

FULLER, Sarah Margaret, Marchioness Ossoli, celebrated authoress, born in Cambridge port, Mass., May 23, 1810; died July 13, 1850. She was the eldest child of Timothy Fuller, a jurist and statesman, learned German, French, Italian, and Spanish, and in 1836 settled in Boston as a teacher of languages. The following year she was chosen principal teacher in one of the schools in Providence, R. I. Besides teaching, she contributed to the New York *Tribune* and other periodicals, and wrote several works of literary value. In 1846 she traveled in Europe, and the following year met Marquis Ossoli in Rome, whose wife she afterward became. In 1848-49 she contributed much to the cause of Italian independence by writing and speaking, and in the latter year had charge of two hospitals during the siege of Rome, while her husband aided the army in defending the city. After the capture of Rome by the French in 1849, she and her husband spent some time in hiding and in 1850 embarked for America. A violent storm drove the vessel on the shoals of Fire Island, near New York, in which they and their infant child perished. The body of the child was found on the beach some time after, but their remains were not recovered.

FULLER, Thomas, clergyman and author, born at Aldwincle, England, in 1608; died Aug. 15, 1661. He graduated at Queen's College, Cambridge, in 1625, and soon after became a divine of the Church of England. In 1631 he was made prebendary of Sarum and later held a number of important charges at different points. During the time of the Commonwealth he sided with the Royalists, and in 1660 was made chaplain to Charles II. His writings include "Church History of Britain," "History of the Holy War," "The Worthies of England," and "Pisgah-sight of Palestine."

FULLER'S EARTH, a kind of greenish-white clay found in many parts of Europe. It is formed chiefly from alumina, with which are mixed lime, silica, and several other ingredients. This clay is much used by manufacturers in cleansing the oil from woolen fabrics, since it is much cheaper than soap.

FULMAR (fo͝ol′mär), a species of aquatic birds belonging to the petrels, native to the island of Saint Kilda and many of the Arctic coasts. These birds are about the size of a domestic duck. They feed on whale blubber, fish, and putrid animal matter. The fulmar is valued for the oil obtained from its stomach and for its feathers and eggs. The natives gather the eggs, considering them excellent as

food. Several species of the fulmar are found in the Pacific Ocean, though they are larger than those native to the Arctic regions.

FULMINATION (fŭl-mĭ-nā'shŭn), the sudden decomposition of bodies by percussion or heat. It is accompanied by light and a loud report. Fulminates or fulminating compounds are explosives formed by preparing fulminic acid with gold, silver, platinum, mercury, or other bases. The percussion caps contain fulminate of mercury, which forms the priming. Fulminating powder is a mixture of niter, sulphur, and potash.

FULTON (fụl'tŭn), a city of New York, in Oswego County, 25 miles northwest of Syracuse, on the New York Central, the Lackawanna, and the Ontario and Western railroads and on the New York State Barge Canal. A public library, waterworks, electric lighting and pavements are among the public improvements. It has an academy, a hospital, and several fine churches. The manufactures include cutlery, flour, condensed milk, and machinery. The first settlement on its site was made in 1791 and its present charter dates from 1902, when the villages of Fulton and Oswego Falls were united. Population, 1905, 8,847; in 1925, 12,571.

FULTON, Robert, noted engineer, born in Little Britain, Pa., in 1765; died in New York City, Feb. 24, 1815. When seventeen years of age he became a portrait and landscape painter, and five years later studied painting in London under West, but soon after abandoned art and engaged in mechanical pursuits. His desire to study engineering was induced by James Watt, the Earl of Stanhope, and the Duke of Bridgewater, with whom he formed an acquaintance. He secured a patent in 1794 on an inclined plane intended to supersede locks on canals. Later, he invented a dredging machine, a mill for sawing marble, a flax-spinning machine, and a machine for making ropes. He proceeded to Paris in 1797 and successfully introduced a boat propelled by steam, and while there he invented a submarine boat useful in torpedo warfare.

ROBERT FULTON.

Fulton visited Scotland to obtain drawings of a steam vessel, the *Charlotte Dundas,* which had plied on the Forth and Clyde Canal. On his return to America, in 1806, he built the *Clermont,* a steamboat of considerable size. In 1807 he successfully navigated the Hudson River, making a voyage of about 150 miles in 32 hours. Soon after a large number of steamboats were constructed. Though not the first inventor of the steamboat, Fulton caused it to come into general use, and to enter as an important factor in developing the interior parts of the United States. In 1814 he secured several valuable patents on an improved steam warship, which was launched in 1815. Subsequently he turned his attention to improving the submarine torpedo, but died before completing it. He published "Torpedo War," "A Treatise on the Improvement in Canal Navigation," and "Advantages of the Proposed Canal from Lake Erie to the Hudson River."

FUNCHAL (fōōn-shäl'), a city in the island of Madeira, of which it is the capital. It is located west of Morocco and southwest of Gibraltar, and is important as a Spanish coaling station. The chief buildings include an opera house, a cathedral, a museum, and the government building. Its site rises abruptly from the sea, hence many of the streets are narrow and steep, but they are nicely lighted by electricity and improved by grading. The harbor is well fortified and is the only port in Madeira that can be reached by large steamers. Its favorable climate has caused it to be popular as a health resort. Population, 1923, 20,986.

FUNCTION (fŭnk'shŭn), the term applied in the study of animal or vegetable life to designate the specific office or work which any organ or system of organs is intended to perform. The vital functions are those which are necessary to life. In the higher animals they consist of the specific office or work of the heart, brain, and lungs. The functions relating to the external world, such as voluntary motion and the senses, are called animal functions. On the other hand, the processes of assimilation, respiration, absorption, digestion, and expulsion are called natural or vegetative functions.

FUNDY (fŭn'dĭ), **Bay of,** an inlet of the Atlantic, separating Nova Scotia from New Brunswick. It is 165 miles long and has an average width of 35 miles. At its upper extremity it branches into Chignecto Bay and Minas Channel and Basin, which are separated from the Gulf of Saint Lawrence by a narrow isthmus. Navigation is rendered dangerous by tides that rise and fall rapidly from fifteen to seventy feet. Grand Manan and other islands are at the southern entrance. The Saint Croix and Saint John rivers flow into the bay. A ship railway connects Chignecto Bay with Northumberland Strait.

FUNGI (fŭn'jī), a large group of flowerless plants, which, in their different forms, are known as mushroom, toadstool, blight, mold, rust, smut, mildew, and by other appellations. Fungi are closely akin to the lichen, but are a lower order and occur in different situations, chiefly drawing their food from the objects on which they are found. Their structure is cellular and they are propagated by spores. Some species grow in green pastures and others on decaying trees, or on grasses or grains, which they

destroy. Many thrive on books and other objects when they are stored in damp places and some are found on man and animals in certain diseases. Fungi are present wherever decay is going on. Many species grow very rapidly, springing up in a single night and dying as quickly, and some grow very slowly, adding to their main body year by year. Various forms of fungi are so small that they can scarcely be seen, while others measure several feet in circumference. Several species are used for food and some are valuable for medicine.

Fungi occur in all parts of the earth where it is not too cold for vegetable growth, but they are most plentiful in moist, temperate climates. Edible mushrooms, well-known species of fungi, grow wild in Europe and America, and are largely cultivated for food. Some species are grown in great quantities for the market. Truffles are fungi growing under ground like the potato and are used for flavoring sauces and meats. They commonly grow about a foot under ground in loose soil, where they are located by dogs trained to search for them as they do for game. Truffles are about the size of a hen's egg, white or brownish in color, and rough and warty on the outside. They are native to Eurasia, but are grown in America. Mildew, rust, and smut grow on plants and destroy them, and are dreaded by gardeners and farmers. There is scarcely any plant that it entirely free from affection by fungus growths, the condition of climate having much to do with their effect. Mold grows on bread or cheese, while mildew appears under certain conditions on cloth or paper, destroying the fiber.

FUNSTON (fŭn'stŭn), **Frederick**, soldier, born in Ohio, Nov. 9, 1865. His father, Edward H. Funston, removed to Kansas in 1867 and served as a member of Congress for ten years. The son graduated from the Iola high school in 1886, attended the Kansas State University, and in 1893-94 aided in exploring Alaska. He joined a Cuban filibustering expedition in 1896, and two years later become commander of a United States regiment, with which he was ordered to the Philippines, where he aided in capturing Manila. In 1901 he headed a detachment of troops to capture Aguinaldo, whom he took prisoner about 200 miles northeast of Manila on March 23. Previous to this, in 1899, he had been made brigadier general and was awarded a sword for bravery by the State of Kansas. In 1906 he had charge of the military forces at San Francisco, where he displayed much energy in protecting the city at the time of the earthquake and the fire. **He died Feb. 19, 1917.**

FUR, the short, soft coat of hair which covers the skin of many mammals. In some species the fur proper is found next to the skin and under the hairs, which are longer and coarser. Fur, in its usual trade acceptation, is a dressed skin containing the short, fine hairs and from which the long hairs have been pulled. Before it is fit for use, a skin must be thoroughly cleaned, steeped, and scoured in a bath of meal, alum, and salt, after which it is washed in soap and soda, cleaned and dried. Other methods are used to prepare for tanning. Furs are often colored, the fur of the seal being commonly changed from a dirty yellow to a rich brown. Al the chief fur-bearing animals, such as the sable, marten, mink, ermine, beaver, and otter, are treated in special articles, which see. The use of furs or fur pelts for covering the body is coeval with the earliest history of all northern nations or tribes. Subsequently it grew into an article of barter and trade, first among themselves and then with their neighbors of more temperate climes, where it became an article of fashion, ornament, and luxury.

The fur trade, in the early history of America, gave rise to vast commercial ventures on the part of individuals and companies, who operated to facilitate settlement and the discovery of unknown wealth. Russia extended its dominion over Siberia to secure the rich fur trade. Practically the same motive induced the Dutch East India Company to turn its attention to America. The French, after establishing trading posts at Montreal and Quebec and exploring the Great Lakes, battled against England many years to retain possession of the region rich in fur-bearing animals. The Hudson's Bay Company, organized in 1670, had exclusive trade with the Indians nearly 200 years, but the royal grant was taken from it in 1868. Since then there have been private collectors and dealers throughout Canada, who compete in the open market for a share of the trade. This likewise is true of Alaska and other regions which are rich in furs. London and Leipzig are the most important fur markets of the world. The enterprise in the United States, although quite extensive, has been conducted by individuals rather than corporations. The Alaska Fur Company holds two of the Aleutian Islands with exclusive right to kill not to exceed 100,000 fur seals yearly. New York City has the largest fur trade in America.

FURIES (fū'rĭz), in mythology, the deities that avenged for all transgressions, frequently mentioned as the Erinyes or the Eumenides. They were supposed to reside in Tartarus. Their number was generally thought to have been three, known as Alecto, Megaera, and Tisiphone, but Aeschylus and other writers mention many Furies in their tragedies. Virgil and the later poets of Rome introduced the Furies, which were of Greek origin, and attributed to them the habit of maddening the transgressor and thus leading him into further crime as an evidence of their punishment. Many ancients spoke of them as the gracious goddesses, fearing that the term angry goddesses might cause them to be more furious.

FURLONG (fûr'lŏng), meaning furrow-length, an English measure of 40 rods, perches,

or poles, equivalent to one-eighth of a mile, or 220 yards.

FURNACE (fûr'nâs), a chamber in which fuel is burned for the production of heat. The heat generated in such structures is commonly utilized in steam engines, melting ores or metals, warming houses, baking bread, and making pottery. While there are various forms of construction, they should be so built that a perfect combustion of the fuel may be possible, and to apply effectually the greatest possible amount of heat. Unless the plans are carefully made, the heat will dissipate without being concentrated directly on the substance to be acted upon in the process of heating. The constructor must likewise aim to supply means whereby an operator can easily control at pleasure the degree of heat necessary. Furnaces are variously designated according to the draught applied. Those in which the draught is natural are called *air furnaces,* those into which a strong current of air is injected by artificial means are termed *blast furnaces,* and those in which a low arch roof is utilized to turn the flame upon the object against which the heat is to be directed are termed *reverberatory furnaces.*

Several classes of furnaces are in use for heating residences and other buildings, such as hot air, hot water, and gas furnaces. In hot-air furnaces the heat is radiated through large pipes into the apartments to be warmed, while in hot-water systems the pipes are connected with radiators in the different apartments, which are filled with water, and this is induced to circulate by applying the heat to a definite portion of the system, thus causing hot water to pass to the different rooms and the colder to flow back into contact with the heater. Heating by steam requires practically the same kind of apparatus. Gas furnaces are those in which gas is utilized for fuel. They are constructed in a manner that either hot air or hot water can be applied. In electric heating the current is obtained from a dynamo, which is propelled by steam generated through the agency of a furnace, or by water power. The outer framework of an electric heater is commonly of thin cast iron, having projections to radiate the heat. Coils of resistance wire, from which the heat of the electric current radiates, are within the framework. From five to twenty amperes are necessary to produce an equable amount of heat on a three-foot heater, on a 110-volt circuit. The heaters are placed where required, connected by wire, and so constructed that the current may be turned on or off by means of a switch, as in an incandescent lamp.

FURNEAUX ISLANDS (fûr-nō'), a group of islands between Australia and Tasmania, so named from Tobias Furneaux (1735-1781), who discovered them in 1773. They are located at the east end of Bass Strait. Flinders Island, the largest of the group, is 10 miles wide and 35 miles long. Cape Barran Island, the second in size, is separated from Flinders Island by Franklin Strait. These islands, for the purpose of local government, belong to Tasmania.

FURNESS (fûr'nĕs), **Horace Howard** author, born in Philadelphia, Pa., Nov. 2, 1833 died Aug. 13, 1912. He graduated at Harvar University in 1854, traveled in Europe thre years, and in 1859 was admitted to the bar a Philadelphia. He prepared several excellen editions of works based on Shakespeare an was honored with a degree at Göttingen Uni versity. Among his best editions are "Rome and Juliet," "King Lear," "Merchant of Venice, "Othello," and "The Tempest."

FURNIVALL (fûr'nĭ-vąl), **Frederic James,** philologist, born in Egham, in Surrey England, Feb. 4, 1825. He studied at the Uni versity College, London, and at Cambridge, wa called to the bar in 1849, and devoted himsel to the study of English literature and the estab lishment of numerous societies. Among th organizations founded are the Early Englis Text Society, the New Shakespeare Society, th Chaucer Society, the Shelley Society, the Brown ing Society, the Ballad Society, and the Wick liffe Society. These societies enabled him t edit many valuable productions from rare writ ings and to collect numerous paintings an manuscripts, for which purpose he spent abou $200,000. Among the most valuable works edite by him are "Early English and Other Works, Chaucer's "Canterbury Tales," Caxton's "Boo of Curtesye," Harrison's "England," and "Lec pold Shakspere." He died July 2, 1910.

FUR SEAL, or Sea Bear. See **Seal.**

FÜRTH (fürt), a city in Bavaria, German six miles northwest of Nuremberg, at the junc tion of the Rednitz and Pegnitz rivers. It is prosperous city and has extensive railway an electric railroad facilities. The chief building include the Church of Saint Michael, the publi library, the Rathaus, and several secondar schools. It has a large trade in hops and mer chandise. Among the manufactures are jewelr toys, machinery, lead pencils, and scientific in struments. Gustavus Adolphus occupied it i 1632, but was defeated by Wallenstein at Al Veste, three miles southwest of the city. Fürt has belonged to Bavaria since 1806. Populatio 1905, 60,635; in 1920, 66,535.

FUSAN (fōō-sän'), or **Pusan,** a city and se port of Corea, on the southwestern coast of th peninsula, seven miles from the mouth of th Nan-tong River. It is connected with Seou the capital, by a railway and has a safe an commodious harbor, which is protected by De Island and several others. Many of the inhab tants are foreigners, chiefly Japanese, to who the place is known as Kan (the post). It has large trade in rice, fish, cotton, hides, and mer chandise. Fusan has been an open port sin 1876. Population, 1922, including Tong-na 39,865.

FUSE (fūz), or **Fuze,** a tube or casing fill

with combustible material and used for igniting a charge in a mine, for blasting, and in discharging a hollow projectile. Fuses were invented as soon as hollow projectiles came into use, and are made in various forms appropriate to the purpose for which they are designed. In mining, blasting, and for submarine purposes a cord or tube which contains a slow-burning composition is used, thereby allowing the operators time to get to a place of safety before it burns down to the charge. Many of these, such as the *Bickford fuse,* are covered with pitch, contain gunpowder, and burn at the rate of one yard in seventy seconds. *Percussion* and *concussion* fuses are used for hollow projectiles. The former contain a capsule charged with fulminate, which is exploded with a plunger, or its equivalent, when the projectile strikes, while the concussion fuse is designed to explode the charge when the shell strikes the object. Time fuses and mechanical fuses are used in some forms of torpedoes with dynamite, gun cotton, and other powerful explosives, and are adapted to burn at different times by cutting off a portion of the cord, or are timed by the character of the composition used. Electric fuses are used extensively in the newer implements of war and methods of blasting, and are adapted to ignite by passing an electric spark through them, thereby bringing the current in contact with the explosive composition within.

FUSEL OIL (fū'sĕl), a heavy, inflammable product formed during the fermentation of molasses, potatoes, corn wort, beet roots, and the juice of grapes. In the rectification of spirits it is separated and occurs as an acrid, or oily, liquid, in the last stages of distillation. It has a peculiar odor, a pungent taste, and is poisonous, producing nervous depression and headache. Its presence in brandy, whisky, and other beverages can be detected by rubbing them on the hand, when ethyl alcohol will evaporate and the fusel oil may be readily recognized.

FUSING POINT, the degree of heat at which any substance begins to melt or liquify. Every substance can be fused at a certain temperature, which is the same in a given substance, if the pressure is constant and uniform, but is very different in different metals and substances. Whenever the fusing commences, the temperature of the body ceases to rise, no matter what the intensity or the source of the heat, and the temperature remains constant until the body is completely fused. On the Fahrenheit thermometer the fusing or melting point of mercury is placed at —37.80°; ice, +32°; butter, +89.6°; phosphorus, +109.4°; sulphur, +237°; tin, +395°; lead, +619°; zinc, +680°; antimony, +809°; silver, +1,832°; gold, +2,282°; and iron, +2,732°. The term *vitreous fusion* is applied in the case of substances that melt gradually and have no definite point of fusion.

FUSIYAMA. See **Fujiyama.**

G, the seventh letter and the fifth consonant in the English alphabet. The Greek name *gamma* is an adaptation of the Canaanite term *gimel,* meaning camel. It has two sounds, the hard and soft, and is formed by placing the tongue against the roof of the mouth, then lowering the tongue and giving utterance to voice. The hard sound occurs before a, o, and u, as in *gate, god,* and *gun;* before the consonants l and r, as in *gloat,* and *groan;* when preceding e and i in beginning a word, as in *get* and *give;* and when final, as in *big.* The soft sound was unknown in Anglo-Saxon. It corresponds to ch, as in *church,* and is represented by g before e, i, and y, as in *gem, gin,* and *gymansium.* G is silent before n, as in *gnat.* As a symbol it represents the seventh of the Dominical letters. In music it is the fifth note of the normal scale of C, called *sol,* and the lowest note of the grave hexachord.

GABELLE (gȧ-bĕl′), a French term derived from the German word *Gabe,* meaning gift or tribute, and applied to the duty imposed upon salt. It was first levied in 1286 as a means to protect the trade in salt, which was made a government monopoly. This tax was very unpopular, since it carried with it the provision that every family was compelled to purchase a certain amount of salt per week, and officers intrusted with the enforcement of the law collected it directly from the people. The law was finally repealed in 1790, owing to a widespread rebellion in some of the provinces.

GABLE (gā′b'l), the upper, exterior part of a wall at the end of a building, which receives the roof. It is triangular in form, the roof sloping from the ridge to the eaves, and comprises the gable end of the wall. In classical architecture, such as the Greek temples, it forms the pediment. During the Middle Ages the gable was usually narrow and pointed, owing to the construction of steep roofs. In Gothic architecture it became quite ornamental, because of the introduction of varous decorative features, including tracery and other ornamentations. Gables continue to be a prominent feature of residential buildings, especially in Europe, but in the newer buildings of cities they have been displaced largely by the walls in continuous blocks.

GABRIEL (gā′brĭ-ĕl), one of the seven archangels mentioned in the Scriptures. He is well known in sacred history on account of announcing the birth of Christ to Mary and the birth of John to Zacharias. In the Talmud he is described as a prince who commands the thunder and presides over the ripening of fruits. The Mohammedans class him with three other angels that wrote the divine decrees, and as the person who guided Mohammed in writing the Koran.

GABUN (gȧ-bo͞on′), or **Gaboon,** an estuary near Libreville, on the western coast of Africa, articulating with the Gulf of Guinea. It is fifty miles long and from seven to ten miles wide. The Como and several other rivers flow into it and it is sufficiently deep for the largest vessels. The country surrounding it was formerly known as the Gaboon territory, which now forms a part of the French Congo. See **French Congo.**

GAD, the seventh son of Jacob by Zilpah, founder of the tribe of Gad in Israel. When Joshua conquered Canaan, the tribe of Gad was assigned territory east of the Jordan, whence they moved northeast and toward the south. It is supposed that they inhabited this country about 700 years, or until about 740 B. C., when they were conquered and carried away in captivity by Tiglath-Pileser.

GADE (gā′dę), **Nils Wilhelm,** composer and musical conductor, born at Copenhagen, Denmark, Feb. 22, 1817; died Dec. 22, 1890. He learned the trade of a cabinet and instrument maker, but abandoned it to take up music. For some time he studied under the leader of the court orchestra and became noted as a student of the romantic school of music. In 1841 he won recognition by his overture entitled "Ossian," for which he was awarded a prize by the Copenhagen Musical Association. The king granted him a stipend for foreign travel and he formed a friendship with Schumann and Mendelssohn. In 1847 he succeeded the latter as director of the Gewandhaus concerts, and three years later became master of the Chapel Royal of Copenhagen. The Danish Folkesthing granted him a life pension of 3,500 crowns. His

productions include "The Springtide Phantasy," "The Erl King's Daughter," "The Crusaders," and "Zion."

GADFLY (găd'flī), or **Horsefly,** the common name applied to various two-winged flies found in the woods and elsewhere during the hot weather. These insects are smaller than the botfly (q. v.). They suck the blood of man and animals and cause a large lump, which forms a tumor and secretes pus, wherever they feed for some time. The eggs are deposited in the skin of animals, and the young subsist upon the pus that exudes from the tumor. The mouth has six sharp needles. These constitute

1, GADFLY; 2, BOTFLY.

a proboscis, or sucker, with which they penetrate the thickest skin. Many species have been described, including the common black gadfly. Another species, the mourning horsefly, has a greenish head and golden eyes.

GADSDEN (găd'zden), county seat of Etowah County, Alabama, on the Coosa River, sixty miles northeast of Birmingham. It is on the Southern, the Louisville and Nashville, the Chattanooga Southern, and other railroads. The surrounding country produces fruits, timber, cotton, corn, coal, and iron ore. It has a number of fine schools and county buildings. The manufactures include flour, machinery, ironware, cotton goods, and steel products. Gadsden was settled about 1845 and incorporated in 1867. Population, 1900, 4,282; in 1920, 14,737.

GADSDEN, James, soldier and diplomatist, born in Charleston, S. C., May 15, 1788; died Dec. 25, 1858. He was the grandson of Christopher Gadsden (1724-1805), a Revolutionary soldier, and served with distinction in the War of 1812. Subsequently he took part in the Seminole campaign in Florida, and in 1822 engaged as a cotton planter in that State. President Polk appointed him minister to Mexico in 1853, in which capacity he negotiated the Gadsden Purchase.

GADSDEN PURCHASE, a tract of land which is now included in New Mexico and Arizona. It embraces an area of 45,535 square miles, and is bounded on the north by the Gila River, on the east by the Rio Grande, on the south by an arbitrary line, and on the west by the Colorado. The average width from north to south is 120 miles. It was purchased from Mexico in December, 1853, for the United States by Gen. James Gadsden for $10,000,000, and the treaty was ratified the following year. The sale of this territory was opposed by many Mexicans and caused Santa Anna to be banished in 1855.

GADSKI (găd'skī), **Johanna,** operatic singer, born at Anclam, Germany, in 1871. She was educated at Stettin, where she developed much ability in music. Though she sang extensively in Germany, her operatic début was made in New York City, where she achieved success as *Brunhilde.* Her strongest parts were carried in Wagnerian rôles. For some time she sang at Covent Garden, in England, and toured Germany and other countries of Europe. In 1898-99 and since she made concert tours of Canada and the United States.

GADWALL (găd'wạl), or **Gray Duck,** a water fowl found in the northern part of both hemispheres, but confined chiefly to bodies of fresh water. It is smaller than the mallard and is a bird of passage. The flesh is highly prized as food. In autumn it moves southward, but returns early in the spring to breed in the northern part of the United States and the southern section of Canada. The color is black and white, but the feathers are variously shaded with brown, giving it a grayish appearance.

GAEL (gāl), or **Gail,** the name of the northern and western branch of the Celtic family of nations. They inhabited the highlands of Scotland, the Isle of Man, and Ireland. Those of the latter country were generally known as Gael of Erin and the others as Gael of Albion. The term Gaelic is now generally applied to the dialect spoken in the highlands of Scotland, which is a branch of the Celtic language, while the people of Ireland and the Isle of Man speak the Irish and Manx, respectively.

GAETA (gà-ā'tà), a fortified seaport city of Italy, on the Gulf of Gaeta, about seventy miles northwest of Naples. The city is located on a promontory, which is crowned by the tomb of Manatius Plancus, who was a friend of Augustus. This structure, known as the Torre d'Orlando, is 160 feet high and is 158 feet in diameter. Gaeta was originally occupied by the Greeks, who constructed many fine public buildings, but it was later conquered by the Romans, who improved and fortified it. Later it was made a part of the Byzantine Empire, was annexed to Sicily in 1184, and was finally captured by the forces of Victor Emmanuel in 1861. Its importance is based largely upon its fortifications, though it has some industries and is visited by tourists for its historical associations. Population, 1922, 5,638.

GAGE, Lyman Judson, banker and public man, born in De Ruyter, N. Y., June 28, 1836; died Jan. 26, 1927. He studied at Rome, N. Y., and removed with his parents to Chicago, where

he became a bookkeeper in a lumber yard and planing mill. Afterward he secured a position with the Merchants' Savings, Loan and Trust Company, and later became manager of the Bankers' Clearing House. In 1882 he was elected vice president of the First National Bank, becoming its president in 1891. He was chairman of the committee to select a site for the World's Columbian Exposition, becoming first president of the exposition company, and was an important factor in its management. In 1894-95 he was president of the civic federation of Chicago. President McKinley made him Secretary of the Treasury in 1897, in which position he actively promulgated the theories of a single gold standard and the enlargement of the powers of national banks. In 1902 he became president of the United States Trust Company in New York City. His later years were spent in retirement at Point Loma, Cal.

GAGE, Thomas, soldier and Colonial Governor, born in Firle, England, in 1721; died April 2, 1787. He saw military service in Scotland and Flanders, and in 1755 was with Braddock's expedition against Fort Duquesne. In 1760 he was appointed governor of Montreal, and subsequently succeeded General Amherst as commander in chief of the British forces in America. When conditions were forming for the American Revolution, he was sent to Boston to repair the fortifications, where he attempted to subdue the antagonism of the colonists to English rule. His destruction of the stores at Concord precipitated the Battle of Lexington. He issued a proclamation offering pardon to all the rebels except John Hancock and Samuel Adams, but this was followed in a short time by the Battle of Bunker Hill, after which he was superseded by Sir William Howe.

GAG RULE, a name applied to any concerted effort to suppress the exercise of the right of a citizen, especially the right of petition. It orginated in 1836, when Congress adopted a rule that all petitions be laid on the table unnoticed. This action was caused by many petitions for the abolition of slavery being presented to Congress. The gag rule was the result of a motion made by John C. Calhoun, but it tended to increase the desire to file petitions, and John Quincy Adams upheld the anti-slavery principles in Congress during ten years. The gag rule was finally rescinded on Dec. 3, 1844.

GAINES'S MILL (gānz'ĕz), **Battle of,** one of a series of battles occurring in Hanover County, Virginia, during the peninsular campaign conducted by McClellan. A part of the Federal army crossed the Chickahominy under command of McClellan, while Fitz-John Porter occupied a position on the north bank of the river with a force of 35,000 men. Generals Lee and Stonewall Jackson made an attack on Porter, June 27, 1862, with a Confederate army numbering 55,000 men. The Federals were driven back with much loss after a two hours' struggle, and were finally forced to give way before superior numbers. Porter crossed the Chickahominy in rapid retreat, burning bridges behind him. His total loss was 6,387 men and 22 guns, and the Confederate loss was somewhat larger. The Battle of Cold Harbor was fought in the same vicinity two years later.

GAINESVILLE, a city in Florida, county seat of Alachua County, seventy miles southwest of Jacksonville, on the Seaboard Air Line and other railroads. Rich phosphate deposits are worked near the city. It is popular as a winter resort. Population, 1925, 8,466.

GAINESVILLE, a city in Texas, county seat of Cooke County, about eight miles south of the Red River and sixty miles north of Fort Worth. It is on the Kansas City Southern, and the Gulf, Colorado and Santa Fé railroads. The surrounding country is agricultural and stock raising. It has a county courthouse, a public library, a high school, and several fine churches. Among the manufactures are soap, ice, brick, flour, brooms, machinery, and utensils. It was settled in 1851 and incorporated in 1873. Population, 1920, 8,648.

GAINSBOROUGH (gānz'b'rō), **Thomas,** landscape painter, born in Suffolk, England, in 1727; died Aug. 2, 1788. His landscape paintings show much originality and delicacy. As a portrait painter he rivaled Sir Joshua Reynolds. His best known paintings include "Rustic Children" and "The Boy Blue."

GAIRDNER (gärd'nēr), **James,** historian, born in Edinburgh, Scotland, March 22, 1828. He was educated at the university in his native city, and at the age of eighteen years became a clerk in the public record office in London, where he was made assistant keeper of the public records in 1859. His patience, accuracy, and eminent fitness for the work of that office caused him to become favorably known, and he displayed the same characteristics in editing a series of historical documents. He contributed to the "Dictionary of National Biography." His published works include "Life and Reign of Richard III.," "Letters and Papers of Henry XII.," "Historical Collections of a London Citizen," "Three English Chronicles," "The Houses of Lancaster and York," and "Studies in English History."

GAIUS, or **Caius,** celebrated Roman jurist, flourished during the reigns of Hadrian, Antonious Pius, and Marcus Aurelius. He was a teacher and writer upon law, not a practical jurist, and is the author of many works upon the Roman law. His writings were not known until 1716, when German scholars discovered them at Verona and other places. The most important is his "Institutes," which was used freely in compiling the works of Justinian, the "Digest of Roman Law." It was first translated into German by Von Brockdorff in 1824.

GALÁPAGOS (gä-lä'pä-gōs), an archipelago of volcanic islands in the Pacific Ocean,

about 650 miles west of Ecuador, of which they comprise a possession. The group includes twelve islands of considerable size, of which Albemarle is the largest. The total area is 2,400 square miles. Much of the surface is mountainous, but the soil is productive. The climate is healthful and favorable to occupation by Europeans. Sugar, fruits, cattle, and goats are the principal products. The islands are remarkable for the presence of many birds, though the flora is limited. Many species of turtles and porpoises prevail and lizards and snakes are well represented. These islands were discovered in 1570 and Darwin explored them in 1836. The government of Ecuador has made a number of attempts to colonize the larger islands, but they are very sparsely settled. Population, 1919, 415.

GALATEA (găl-ȧ-tē'ȧ), in mythology, the sister of Thetis, daughter of Nereus and Doris, and aunt of Achilles. She was loved by the Cyclops Polyphemus, but she rejected him and married a shepherd of Sicily named Acis. In a fit of jealousy the Cyclops slew her lover. Greek and Latin poets made the love of Polyphemus a favorite subject in their writings.

GALATIA (gȧ lā'shĭ-ȧ), the name anciently applied to an extensive region of Asia Minor, so called from a large number of Gallic inhabitants, who settled there about 277 B. C. The Gallic invaders of Greece in the 3d century B. C., under Brennus, not only took possession of Byzantium, but crossed the Hellespont, and subdued a large portion of Phrygia and Troas. Later they were confined to certain districts by Attalus, King of Pergamus, the settlements being bounded by Phrygia, Lycaonia, Pontus, Cappadocia, Paphlagonia, and Bithynia. The Galatians retained their old Celtic language more or less distinctly for several centuries, were twice visited by Saint Paul, and produced numerous scholars. In government they were divided into three tribes and twelve tetrarchies, each being under a chief. Saint Paul addressed one of his epistles to the churches in Galatia.

GALATIANS (gȧ-lā'shȧnz), **Epistle to the,** a book of the New Testament, addressed by Saint Paul to the churches of Galatia. Many Hebrew converts belonged to the churches of Galatia and they had incorporated Jewish rites with the ordinances of Christian worship. Paul recalls them to the simplicity of the Gospel in this epistle, in which he vindicates his apostolic commission, urges the doctrine of salvation as the cardinal truth of Christianity, and concludes with exhortations and a benediction. It is thought that this epistle was written earlier than those addressed to the Thessalonians.

GALATZ (gă'lȧts), or **Galacz,** a city of Rumania, in Moldavia, on the Danube River, 85 miles above the Sulina mouth. It is situated between the mouths of the Perth and the Sereth and is important for its railroad and river transportation facilities. The trade consists chiefly in grain, tallow, wine, cheese, wool, and fruits. Among the manufactures are clothing, earthenware, machinery, cigars, and leather. It is the seat of a bishop and several schools. Among its principal buildings are a convent, a hospital, several Greek churches, and a number of large bazaars. It has been the scene of many battles between the Turks and Russians. In 1883 it was made a free port. Population, 1922, 65,503.

GALBA (găl'bȧ), **Servius Sulpicius,** Emperor of Rome, born near Terracina, Dec. 24, 3 B. C., died Jan. 15, 69 A. D. He descended from a wealthy family and was a friend of Augustus and Tiberius. In 20 A. D. he became praetor, was made consul in 33, and in 39 commanded an expedition against the Germans in Gaul. He was intrusted with the administration of Africa in 45, but afterward incurred the enmity of Nero, who plotted to have him assassinated. However, he assumed the title of legate and marched toward Rome, and was made emperor by the praetorians on the death of Nero. His administration soon became unpopular among the praetorian guards, and he incurred the displeasure of the senate by choosing Piso instead of Otho to become his successor. The latter formed a conspiracy among the soldiers and Galba was assassinated in the senate.

GALEN (gā'lęn), **Claudius,** noted Greek physician, born in Pergamus in Mysia, in 130 A. D.; died about 201. He was a profound student of medicine, practised as a physician in the school of gladiators in Pergamus, and later settled in Rome, where he attended Emperor Marcus Aurelius and his household and afterward Emperor Severus. Eighty-three of his treatises are extant, besides which are many others which are regarded spurious. His writings were taken as good medical authority until the 16th century and many are still frequently consulted, especially those treating anatomy and physiology. Galen established the practice of consulting the pulse in the diagnosis of diseases. He treated the works of Hippocrates in numerous commentaries.

GALENA (gȧ-lē'nȧ), or **Lead Glance,** the sulphurate of lead, the ore which furnishes most of the lead of commerce. Pure galena contains 13.3 per cent. of sulphur and 86.7 of lead, but it is usually mixed with a small proportion of copper, silver, zinc, antimony, or selenium. The color resembles that of lead, but it has a metallic luster. It is usually found massive, but sometimes granular or crystallized. The fragments are cubical, into which it is easily broken. It is found in beds, veins, and imbedded masses, frequently accompanying other metallic ores. *Argentiferous galena* is the name applied to deposits that contain a large proportion of silver. Deposits of galena occur in many parts of Canada and the United States, especially in the Rocky Mountains. It is mined near Galena, Ill., in Missouri, Colo-

rado, Wisconsin, British Columbia, and other sections of North America.

GALENA, county seat of Jo Daviess County, Illinois, on the Fevre River, eighteen miles southeast of Dubuque, Iowa. It is on the Chicago, Burlington and Quincy, the Illinois Central, and the Chicago and Northwestern railroads. The noteworthy buildings include the county courthouse, the public library, the Federal building, and the high school. Grant Park contains a statue of U. S. Grant. The surrounding country is agricultural and produces zinc, lead, and other minerals. Among the manufactured products are furniture, ironware, boots and shoes, machinery, brick, cigars, dairy products, and woodenware. The city has electric lighting, a sewerage system, and waterworks. Ulysses S. Grant resided in Galena a number of years. It was settled in 1827 and incorporated in 1839. Population, 1920, 4,742.

GALENA, a city in Cherokee County, Kansas, in the southeastern part of the State, seven miles west of Joplin, Mo. It is on the Kansas City Southern, the Saint Louis and San Francisco, and other railroads, and is surrounded by a lead and zinc producing country. The chief buildings include a public library and several fine public schools and churches. It has a foundry, grain elevators, and several smelters. The vicinity was first settled in 1877 and owes its development largely to its mineral interests. Population, 1900, 10,155; in 1905, 6,499; in 1925, 4,786.

GALESBURG (gālz'bûrg), a city and the county seat of Knox County, Illinois, about 163 miles southwest of Chicago, on the Chicago, Burlington and Quincy, the Atchison, Topeka and Santa Fé, and other railroads. The surrounding country is agricultural and dairying, and contains an abundance of bituminous coal deposits. It has a fine county courthouse, a public library of 40,000 volumes, and an armory. The institutions include Knox College, Lombard University, Saint Joseph's Academy, and Brown's Business College. Among the municipal facilities are paved streets, gas and electric lighting, electric street railways, and a system of city parks. The manufactures include flour, brooms, tile, bread, tobacco, brick, engines and boilers, and farming machinery. Population, 1900, 18,607; in 1920, 23,834.

GALICIA (gā-lĭsh'ĭ-ā), a province of Poland, whose boundary is formed by Russia on the north and east, and by Rumania and Czecho-Slovakia on the south and west. It has an area of 30,315 square miles. The Carpathians form the southern border. Its chief rivers are the Dniester and several tributaries of the Danube and Vistula. Among the principal products are cereals, beef and dairy cattle, horses, poultry, fruits, silk, and divers manufactures. The minerals include coal, alabaster, copper, rock salt, iron, marble, and calamine, of which iron and rock salt are the most important. The inhabitants consist chiefly of two Slavic peoples, the Poles and Ruthenians, but they include many Germans and Greeks. A well-organized public school system is maintained, which terminates in the celebrated universities of Lemberg and Cracow. Lemberg is the capital. Among the other important cities are Cracow, Przemysl, and Tarnapol. Extensive lines of railroads and navigable streams facilitate commercial intercourse. Owing to its productive soil and other natural resources, the province holds a position of importance in the Austrian commonwealth.

Galicia was originally inhabited by Germanic peoples, but the Poles and Ruthenians immigrated in large numbers in the Middle Ages. In the 12th century it was made an independent state, but it soon became tributary to Poland. In 1772, at the first partition of Poland, it was annexed to Austria. The Russians captured Lemberg and Przemysl and overran most of the province in 1915, but were defeated and expelled by the German allies. Population, 1922, 8,340,520.

GALILEE (găl'ĭ-lē), the name applied anciently to one of the four Roman divisions of Palestine. It was bounded by the Jordan River on the east, by Samaria on the south, by the Mediterranean and Phoenicia on the west, and by Syria and the mountains of Lebanon on the north. The northern portion is wooded, but the lower part is level and exceedingly fertile. In the time of Christ the former was usually called Upper Galilee and the latter was known as Lower Galilee. At present the whole of Galilee is included in the vilayet of Syria. Within this region were situated the twenty towns given by Solomon to Hiram, King of Tyre, as compensation for his assistance in building the temple.

Galilee was the early seat of Christian influence and its four towns, Nazareth, Capernaum, Nain, and Cana, are closely associated with the life and travels of Christ. The inhabitants consisted chiefly of Greeks, Syrians, Phoenicians, Arabs, and Jews, and occupied themselves largely as fishermen. They were held in contempt by the educated Jews because of their simplicity of manner and lack of education, on account of which the name Galileans was early applied to Christians. Galilee became the seat of the Jewish doctors of law after the destruction of Jerusalem, and Jewish learning centered largely at Tiberias. Numerous ruins still exist in some portions of Galilee, though most of the region is populated by a destitute people and the towns are stricken with poverty and indolence.

GALILEE, Sea of, an inland lake of Syria, also called Sea of Tiberias, Lake of Gennesaret, and Sea of Chinneroth. It is situated on the east central boundary of Palestine. The surface is 682 feet below the Mediterranean sea. Its extent from north to south is twelve miles; width, seven miles; and general depth,

825 feet. The basin is of volcanic origin, the water is fresh and cool, and the northern and eastern coasts are precipitous and barren. It receives the inflow from the Jordan and several other streams, abounds with edible fish, and is known for its association with many important events connected with Christ and the apostles. The region surrounding the lake was densely populated in the time of Christ, though at present there are only the remains of ruined towns, including Capernaum, Magdala, Tiberias, and several others of minor importance. A railroad line connects the lake region with the Mediterranean Sea, and offers assurance that at least a limited amount of prosperity will come to the people within the next few decades on account of increased commercial, fishing, and manufacturing enterprises.

GALILEO (găl-ĭ-lē'ō), the common name of Galileo Galilei, distinguished physicist and astronomer, born in Pisa, Italy, Feb. 15, 1564; died Jan. 8, 1642. He descended from an ancient Florentine family, secured the advantages of early training in literature and arts, and entered the University of Pisa in 1581. Soon after he was induced to investigate the laws of the oscillation of the pendulum by a lamp he saw swinging in the Pisa cathedral, and by it was subsequently led to apply his discovery in the exact measurements of time. The works of Archimedes suggested the hydrostatic balance, which he invented in 1586. In 1589 he became professor of mathematics in the University of Pisa. Having devoted much time to the study of mathematics and natural science, he soon attracted the attention of many learned men. While at Pisa he discovered the law of falling bodies by experiments conducted from the leaning tower at that place, which led him to renounce much of the accepted philosophies, and thereby drew upon himself the enmity and criticism of other scholars.

GALILEO.

In 1592 he accepted the professorship of mathematics at Padua, where he lectured until 1610, and in the meantime enriched the world of science with many valuable inventions and discoveries. Among those announced within this period are a number of improvements in the thermometer and the refracting telescope, discoveries in relation to magnetism and the magnet, and the discovery of the satellites of Jupiter. He discovered the rings of Saturn, the sun spots, and the inclination of the sun's axis to the plane of the ecliptic. Galileo's improvements on the telescope were suggested by a report of the first telescope invented in Holland, in 1608. The following year he constructed an instrument by which objects were magnified three times, and finally produced one that magnified thirty-two times.

In 1610 Galileo was appointed philosopher and grand-ducal mathematician at Florence by Cosmo II., Grand Duke of Tuscany, which afforded him an increased salary and abundance of leisure to promulgate his scientific investigations. By the discovery of the phases of Mercury, Venus, and Mars he further demonstrated the truth of the Copernican theory. He visited Rome for the first time in 1611, where he was received with great distinction, but shortly after was criticised for teaching heresies, to which he replied in a masterful treatise and clearly demonstrated the discoveries resulting from his study of the heavens. His work was examined by a congregation of mathematicians, monks, and cardinals, who condemned it as dangerous to the church and science, summoned him before the Inquisition, and in 1633 the veteran philosopher was compelled to fall upon his knees and abjure by oaths the truths he had discovered and so ably maintained.

It is claimed by some writers that when Galileo rose, after abjuring the truths he had discovered, he exclaimed, *E pur si muove*, meaning, "But nevertheless it does move." The Inquisition thereupon sentenced him to the dungeon for three years, but shortly after permitted him to reside in Sienna and later in Florence. Though losing an eye by disease and having the other highly impaired, he continued his researches, and in 1637 discovered the libration of the moon. His death occurred the year of Newton's birth, after a long and useful life, which was saddened by persecutions and domestic troubles. He was buried in the church of Santa Croce, Florence. The writings of Galileo exhibit a high degree of literary style, cover a wide range of subjects, and are still consulted extensively by learned men. Natural philosophy is as greatly indebted to him as the science of astronomy.

GALION (găl'ĭ-ŭn), a city of Crawford County, Ohio, eighty miles southwest of Cleveland, on the Erie and the Cleveland, Cincinnati, Chicago and Saint Louis railroads. The surrounding country is cereal, fruit, and stock producing. It has a public library, a fine high school, and several costly church and business buildings. Among the manufactures are garments, ironware, flour, pottery, brick, tobacco, and machinery. It is well improved and has many modern facilities, such as electric lighting and street pavements. The place was platted in 1831 and incorporated in 1878. Population, 1900, 7,282; in 1920, 7,374.

GALL (gal), **Franz Joseph,** founder of phrenology, born in Tiefenbrunn, in Baden,

Germany, March 9, 1758; died Aug. 22, 1828. He studied in Baden, Strassburg, and Vienna, practiced medicine at the last-mentioned city, and spent much time in the study of human and animal skulls. After several decades of close application to phrenology, he announced the particular location of twenty organs, wrote and lectured extensively, and attracted widespread attention. For some time he was associated with Dr. Spurzheim at Paris. His field of operation was throughout German-speaking countries, France, and Great Britain. Among his most important writings are "Philosophical and Medical Investigations" and "Anatomy."

GALLAIT (gäl-lā′), **Louis,** historical painter, born in Tournai, Belgium, March 10, 1810; died in Brussels, Nov. 20, 1887. He is considered the most noted historical painter among the Belgians of modern times. His chief works include "The Abduction of Charles V.," "The Family of a Prisoner," "Alva Viewing the Dead Bodies of Egmont and Hoorn," and "A Plague of Tournai." The last mentioned was purchased for the Brussels museum at $24,000.

GALLAS (gäl′läs), or **Oroma,** a race of Ethiopian people who inhabit the eastern part of Africa, chiefly south and east of Abyssinia. They seem to hold an immediate place between the Negroes and the Arabians.

GALLI-CURCI, Amelita, soprano singer, born in Milan, Italy, Nov. 18, 1889. Her first triumph was won at Rome, where she appeared before a large audience in the principal opera house, and subsequently sang in tours abroad, including North America and South America. Her singing is not only brilliant and artistic but coupled with this faculty is a magnetic personality. Besides singing in public before large audiences she produced extensively for the phonograph and the radio. In opera singing she starred extensively, especially in *Dinorah* and as Juliet in *Romeo and Juliet.*

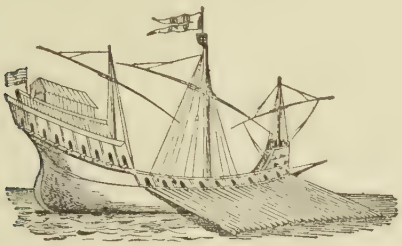
GALLATIN (găl′ă-tĭn), **Albert,** famous statesman, born in Geneva, Switzerland, Jan. 29, 1761; died Aug. 12, 1849. In 1779 he graduated from the University of Geneva, emigrated to America the following year, and enlisted for a brief period in the American army. Shortly after the close of the Revolutionary War he taught at Harvard College, became a naturalized citizen in 1786, and three years later was elected a member of the Pennsylvania State convention. He was chosen United States Senator in 1793, but was not admitted to his seat, and the following year aided in suppressing the Whisky Insurrection. From 1795 to 1801 he was a member of Congress from Pennsylvania, being elected as a Democrat, and took a leading part in national legislation. President Jefferson appointed him Secretary of the Treasury, which position he filled from 1801 to 1813, and as such became known as one of the ablest financiers of America. He was a peace commissioner in 1813-14, aiding in negotiating the Treaty of Ghent, which concluded the War of 1812. From 1816 to 1823 he was United States minister to France, and in 1826 became envoy extraordinary to Great Britain. On returning to America in 1827, he became president of a bank in New York City. Subsequently he published numerous pamphlets, including several on finance, the war with Mexico, the Oregon question, and various other political and national issues. The most valuable of his publications is "Synopsis of the Indian Tribes," a people to whom he gave much study.

GALLAUDET (găl-lą-dĕt′), **Edward Miner,** educator, born in Hartford, Conn., Feb. 5, 1837. He graduated at Trinity College and in 1855-57 was instructor of the Deaf and Dumb Institution at Hartford, which was founded by his father, Dr. Thomas H. Gallaudet. He removed to Washington, D. C., in the latter year and aided in organizing the Columbian Institution for the Deaf and Dumb, and in 1864 became president of the National Deaf-Mute College at Washington. He made an extensive tour of Europe in 1867-68 to visit the principal institutions for the deaf and dumb and on his return to America published a valuable report of his observations. In 1880 he went to Milan, Italy, as delegate to the international congress of instructors of deaf-mutes, and was president of the convention of instructors of deaf-mutes at Jacksonville, Ill. The government of Great Britain invited him to that country, which invitation he accepted in 1886, to give information regarding the methods of teaching the deaf, dumb, and blind in America. Besides writing a memoir of his father, he published "A Popular Manual of International Law." He died Sept. 26, 1917.

GALL BLADDER, a pear-shaped sac attached to the liver, lodged in a groove on the lower side of that organ. It contains the bile, which is stored for a brief time, or as needed for use in digestion. The bile enters through the cystic duct into the gall bladder, where it becomes viscid and of a darker color, and passes from it to the gall duct when the food enters the small intestines. Three coats compose the walls of the gall bladder: the inner or mucous coat, the intermediate or muscular coat, and the serous or outer coat. The sphincter muscle, which opens and closes the opening into the duodenum, is subjected to a reflex movement when the bile is discharged. See Bile.

GALLEY (găl′lĭ), a vessel formerly used extensively in the Mediterranean. It is low and flat-built, has one deck, and is navigated with sails and oars. The length varied from 100 to 200 feet, the medium sizes being known as half galleys and the smallest as quarter galleys. On each side were twenty oars, which were worked by several men, and there were

two masts covered with lateen sails. The *galleasses* were the largest in size. They had beams thirty feet long, carried three masts and about twenty guns, and were propelled by about 250 rowers. In the reign of Charles VI. they were introduced into France, but were abolished in 1748 by Louis XV. These vessels were used for offensive and defensive warfare, and in the time of peace served in furthering commercial enterprises. Similar vessels were



VENETIAN GALLEASS.

kept by the ancient Greeks and Romans for war purposes, but during the time of peace they aided in commerce and colonization along the seacoast. In printing, a galley is an oblong tray, used to receive the type from the composing stick, and which serves to arrange it in a column or page. The galley has a flange, about one-half an inch in height, on both sides and at one end. After being taken from the galley to the imposing stone, the type is arranged in a chase.

GALLINGER, Jacob H., public man, born in Cornwall, Ontario, March 28, 1837; died Aug. 17, 1918. He began to practice medicine in 1858, and was elected a member of the New Hampshire Legislature in 1872. He was State Senator for three years, serving as president of the Senate in 1879-80. For two years he served as surgeon general of the State, with the rank of brigadier general. In 1891 he was elected as a Republican to the United States Senate and was reëlected in 1897 and 1903.

GALLIPOLI (gȧl-lēp'ō-lē), a seaport city of European Turkey, in the vilayet of Adrianople, 125 miles southwest of Constantinople. It is located at the northern end of the Dardanelles and was once strongly fortified, but its commerce has declined and the fortifications are in a dilapidated condition. The streets are irregular and poorly paved, but it has a number of fine bazaars and many mosques. The manufactures include cotton and silk goods, leather, clothing, and utensils. The town was of great importance in ancient times, since it commands the entrance into the Sea of Marmora. The Turks captured it in 1354 and in 1854. It was the scene of vast military operations in the Crimean War as well as in 1914 and 1915. Population, 1922, 28,950.

GALLIPOLIS (găl-lĭ-pō-lēs'), a city of Ohio, county seat of Gallia County, 56 miles southeast of Chillicothe. It is located on the Ohio River and on the New York Central and other railroads. The surrounding country contains valuable coal deposits. The manufactures include stoves, furniture, leather, and machinery. Waterworks, electric lights, and sewerage are among the facilities. It is the seat of the Ohio Hospital for Epileptics, a public library, and many fine schools and churches. It was settled by French colonists in 1790 and was chartered as a city in 1865. Population, 1900, 5,432; in 1920, 6,070.

GALLIUM (găl'lĭ-ŭm), a chemical element discovered in 1875 by the French chemist Lecoq de Boisbaudran. It resembles aluminium in the character and composition of its compound, and is obtained in a number of zinc blends, especially on the Rhine. It has a gray color and a brilliant luster, and may be hammered into thin plates that do not break easily by bending. See **Chemistry.**

GALLON (găl'lŭn), a measure of capacity used in measuring liquids. The standard gallon, sometimes called wine gallon, contains 231 cubic inches and is used in the United States. It is equal to 8.3388 avoirdupois pounds, or 3.7853 liters. A gallon contains four quarts and is equal to eight pints, or thirty-two gills. The English imperial gallon contains 277.274 cubic inches and is equal to ten pounds avoirdupois of distilled water.

GALLS, or Gallnuts, the abnormal growth produced on growing plants by a number of insects or closely allied mites. These insects deposit their eggs in the bark or leaves, and within the galls that subsequently develop are nourished and developed the young in certain stages of their growth. The deformities vary in form, color, and texture, ranging from the simple pouchlike bulging of the leaf to the most imperfect and complicated structure. Many gallnuts are important as articles of commerce, especially those obtained from the dwarf oak in Western Asia. They are brought to America principally from Syria and Asia Minor, and vary in size from that of a pea to that of a nutmeg. Those gathered when of good size, but before the insect by which they are caused has eaten its way out, are the best commercial product. They are known as *black* or *blue galls* and are rich in gallic acid, which is used in medicine and for the manufacture of ink and dyes. Those gathered after the insect has escaped are called *white galls* from their lighter dingy color. Those engaged in the enterprise of cultivating trees for their galls examine them carefully about the season of gathering, in order that they may be collected in their best condition. Gall insects are very numerous. They include the gadfly, the sawfly, and some species of mites, aphides, and spiders.

GALLSTONES. See **Bile.**

GALT (gąlt), a city of Ontario, in Waterloo

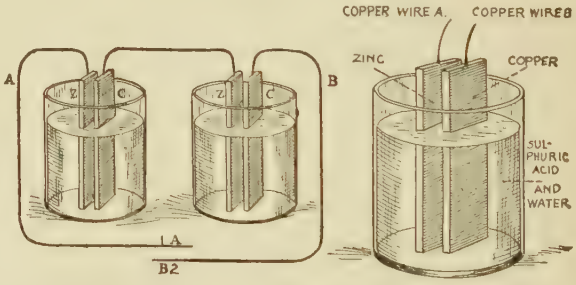
County, on the Grand River, 54 miles from its entrance into Lake Erie. It is on the Canadian Pacific and the Canadian National railways and is surrounded by a fertile region. Waterworks, electric lighting, and street pavements are among the public utilities. The manufactures include flour, woolen goods, ironware, edgeware, and machinery. It has a considerable trade in produce and merchandise. Several educational institutions, including a collegiate institute, are located here. It was named from John Galt, the Scotch author. Population, 1901, 7,866; in 1921, 13,210.

GALT, Sir Alexander Tilloch, financier and statesman, born in London, England, Sept. 6, 1817; died Sept. 19, 1893. He emigrated to Canada at an early age and became a clerk in a private land office. In 1844 he was made the manager of the estates of his company and five years later became a member of the Canadian Parliament, in which he served a long term of years. He became Minister of Finance at an early date in his official career and served on the Halifax Fishery Commission. In 1880-83 he was High Commissioner for Canada in England, and in the latter year became a member of the executive committee of the International Fishery Exhibition. He published "Church and State in Canada," "Future of the Dominion of Canada," and "Canada from 1849 to 1859."

GALTON (gạl'tŭn), **Francis,** explorer, born in Duddeston, England, in 1822. He was a cousin of Charles Darwin, attended King Edward's School in Birmingham, and later graduated at Trinity College, Cambridge. In 1846 he traveled in Africa, visited many places of interest in Egypt and the cataracts of the Nile, and in 1850 explored in South Africa, including Damaraland and Walfisch Bay. He was the first to penetrate inland from the coast to Lake Ngami, of which region he published a valuable report. In 1863 he demonstrated the existence and established the theory of anticyclones, prepared several charts relating to the elements of the weather, and laid the foundation of weather forecasts. He is the inventor of instruments relating to geographic and meteorologic affairs, and devised apparatus for taking measures in psychology. His chief publications are "Narrations of an Explorer in Tropical South Africa," "Meteorographica, or Methods of Reporting the Weather," "Hereditary Genius," "Inquiries into Human Faculty," "Natural Inheritance," and "Index of Finger Prints." He died Jan. 17, 1911.

GALVANI (gạl-vä'nē), **Luigi,** famous physician and anatomist, born in Bologna, Italy, Sept. 9, 1737; died Dec. 4, 1798. He studied in the University of Bologna, entered upon the practice of medicine at that place, and in 1762 was appointed professor of anatomy at the university. In 1791 he published a work relative to his discoveries and theories of animal electricity, and prepared a number of treatises showing advanced views in the study of comparative anatomy. He was deprived of the chair of anatomy at Bologna in 1797, in consequence of his refusal to take the oath of allegiance to the Cisalpine Republic, but afterward was restored to the position. His theories of animal functions in relation to electricity were largely deduced from numerous experiments, and led to valuable results in the knowledge of galvanism, and to the invention of instruments for measuring the force of electric currents. While his writings are not numerous, they are characterized by precision and minuteness of detail. Among them are "On the Organs of Hearing of Birds" and "Considerations on the Urinary Organs of Birds."

GALVANIC BATTERY (găl-văn'ĭk), or **Voltaic Battery,** a combination of two metals in a liquid chemically acting upon one to a greater extent than the other. The discovery is due to Luigi Galvani (q. v.), from whom the name was applied. In experimenting with the legs of recently killed frogs he noticed that, when hung up against an iron balustrade and the large nerves of the frogs' legs were brought in contact with the metal, they twitched as violently as in life. This phenomenon was due to bringing the muscles into electric connection. He ascribed the action to a vital fluid, which he thought came out of the nerves and flowed through the iron to the muscles. The experiments attracted the attention of Volta, a distinguished physicist of Pavia, who showed that these movements were caused by electricity and constructed an arrangement called a *voltaic battery* or *pile,* by which powerful continuous currents could be readily produced.



GALVANIC BATTERY OF TWO CELLS. VOLTAIC CELL.

The simplest form of the voltaic cell consists of a plate of zinc and a plate of copper immersed in water containing sulphuric acid. The accompanying illustration shows a single voltaic cell and a battery of two cells, showing the method of coupling up the plates of continuous cells. No action takes place, if the zinc is pure, until a complete circuit is made by connecting the plates with a wire, but the plates must not come in contact with each other in the liquid.

The action occurs between the liquid and the zinc, and hydrogen gas is seen to escape in minute bubbles from the copper. This gas, being produced by the current of electricity, continues to flow in the circuit as long as the chemical action continues. In this simple voltaic cell the end of the projecting copper plate is the positive pole or terminal, and the corresponding end of the zinc plate is the negative pole or terminal.

Many forms of voltaic cells are in use, but usually they are arranged in two classes—single-fluid cells and double-fluid cells. In the former only a simple electrolyte is employed, and in the latter two different electrolytes are used, one for each element of the voltaic couple. Ordinary zinc is impure and, when the circuit is broken, is wasted by the electrolyte acting upon it. This tends to weaken the strength of the current when the circuit is replaced. The waste may be averted by amalgamating the zinc, which is done by dipping it in acid and then rubbing mercury over its surface. A battery consists of two or more voltaic cells so connected as to secure a stronger current than can be obtained from a single cell. By constructing a battery with a large number of cells it is possible to overcome a powerful resistance or to supply a strong current.

GALVANISM (găl'vȧ-nĭz'm), the branch of electric science which treats of current electricity arising from chemical action, as distinguished from that generated by heat or induction. The term came into use from Galvani, the discoverer of animal electricity. See **Galvanic Battery; Electricity,** etc.

GALVANIZED IRON (găl'vȧ-nīzd), the name given to iron which is covered by a coat of zinc, with or without galvanic deposition. Properly galvanized iron is a sheet of iron first plated with tin and then immersed in a sal ammoniac and zinc mixed fluid, which forms another coating. Less properly the iron is cleaned by diluted acid and friction, heated, and, without any galvanic current, is plunged into a bath of melted zinc covered with sal ammoniac and stirred until the surface becomes coated with zinc. Articles made of galvanized iron, such as household utensils, fencing wire, roofing sheets, and water pipes, are proof against corrosion as long as the iron is covered with the coating.

GALVANOMETER (găl-vȧ-nŏm'ĕ-tĕr), an instrument used for measuring or indicating delicate currents of electricity. Many forms of this instrument are in common use, but all of them take advantage of the force exerted by currents on movable magnets in their neighborhood. The common form consists of an electro-magnet, on which a magnetic needle is balanced. The direction of the current is indicated as the needle is turned toward the right or the left, and a scale of degrees indicates the strength of the current as the needle moves. In the tangent galvanometer, which is used to measure stronger currents, the conducting wire is carried in the circumference of a circle entirely around the needle so that its diameter is ten or twelve times the length of the needle. The current in these instruments is proportional, not to the angle through which the needle turns, but to the tangent of the needle.

GALVESTON (găl'vĕs-tŭn), a city of Texas, county seat of Galveston County, on Galveston Island, at the entrance of Galveston Bay. It is on the Southern Pacific, Gulf, Colorado and Santa Fé, the Kansas City Southern, and other railroads, and has direct steamboat connection with the leading ports of America and Europe. The bay is from ten to twenty miles wide and about thirty miles long, and the island has a width of three miles and a length of about thirty. An extensive breakwater has been constructed to protect the harbor, which affords unexcelled anchorage for the largest vessels. Intercommunication is by a network of electric railways, with which are connected several suburban and interurban lines. The city is protected from overflows by a sea wall of cement and concrete. This structure, completed in 1925, is seven miles long, five feet wide at the top and sixteen feet at the base, and is seventeen feet higher than the mean low tide.

The city has an area of about fourteen square miles and is built mainly toward the inland side of the island. It has well-improved streets, especially the newer part, where much has been done to raise the surface by grading. Among the noteworthy buildings are the county courthouse, the customhouse and post office, the Ball High School, the Rosenberg Library, the Masonic Temple, the Y. M. C. A. building, and many business houses and hotels. It is the seat of the medical department of the State University, two Roman Catholic academies, Saint Mary's Hospital, two orphan asylums, and other institutions. A railroad bridge nearly two miles long connects the island with the mainland.

As a cotton market Galveston is one of the most important centers in the United States, while its trade in lumber, wool, live stock, and cereals is correspondingly large. Among the manufactures are flour, ironware, woodenware, cotton-seed oil, clothing, fabrics, and machinery. It ranks second in exports among the exporting cities of the United States and its exports of cotton are paralleled only by those of New Orleans. The municipal improvements, such as gas and electric lighting, waterworks, sewerage, and pavements, are well established. Galveston was settled in 1837 and incorporated in 1839. General Magruder captured it for the Confederates in 1863. In 1900 a large part of it was destroyed by a severe storm, but it was rebuilt with an enterprise equaled only by the activity of its business men. Population, 1920, 44,255.

GALVESTON BAY, an inlet on the southeastern shore of Texas, extending about thirty

miles inland from the Gulf of Mexico. It is separated from the latter by Galveston Island, which is connected with the mainland by a railway, whose terminus is at Port Bolivar, opposite Galveston. The area is about 450 square miles.

GALWAY (gal'wā), a seaport city of Ireland, capital of Galway County, 120 miles west of Dublin. It is located at the mouth of the Corrib River, on the northern shore of Galway Bay, and has a large export trade in wool, fish, marble, and agricultural produce. The manufactures include flour, canned fish, ironware, and spirituous liquors. The older part of the town has crooked streets, but the newer part is well platted and built of substantial material. Among the chief buildings is the Church of Saint Nicholas, founded in 1320. It has a fine county courthouse, five nunneries, and three monasteries, and is the seat of Queen's College. The city has railroad and electric railway facilities, waterworks, and gas and electric lighting. The Irish language is spoken by many of the people. Population, 1922, 13,634.

GALWAY BAY, an important bay on the western coast of Ireland, extending inland from the Atlantic, between the counties of Clare and Galway. It is from six to twenty miles wide and thirty miles long, and at its entrance are the Arran Islands. Galway, a seaport of western Ireland, is situated on the northern shore.

GAMA (gä'mà), **Vasco da,** famous navigator, born at Sines, in the province of Alemtejo, Portugal, in 1469; died in Cochin, India, Dec. 25, 1524. He descended from an ancient royal family, distinguished himself as a mariner at an early age, and in 1497 was given command of an expedition to discover a southern passage to India. The expedition included four vessels, equipped with abundant apparatus and manned with 160 sailors. He sailed from Lisbon on July 8, 1497, and after a stormy voyage of four months reached Saint Helena Bay, near the Cape of Good Hope. Later he doubled the cape, cruised along the coast of Mozambique, and visited Mombaza, Melinda, and Calicut, India, reaching the last-mentioned place May 20, 1498. After remaining at Calicut for some time, the ruler became hostile, and Gama was obliged to resort to forcible means in order to leave the harbor.

In September, 1499, he returned to Lisbon, where he was received with much enthusiasm, made a noble, and named admiral of the Indies. He was granted an annual pension and extensive commercial privileges in India. In 1502 he was sent to Calicut with a fleet to avenge the destruction of a Portuguese colony, where he destroyed the Indian fleet, secured a favorable treaty of peace, and on his return voyage to Portugal founded colonies in Mozambique and Sofala. King John III. appointed him viceroy of India in 1524, but he died there three months after landing. The remains were taken back to Portugal and buried with military display. Gama ranks in importance as an explorer and navigator above all others with the exception of Columbus. He succeeded in largely widening the influence and importance of the commerce and prosperity of Portugal.

GAMBETTA (găm-bĕt'tà), **Leon,** noted statesman, born in Cahors, France, April 3, 1838; died in Paris, Nov. 27, 1882. He secured a college education and studied law in Paris. Becoming imbued with republican doctrines, he opposed the Napoleonic oppression of liberal thought. He was elected to the Chamber of Deputies in 1869 from the Paris district and in 1870, when Napoleon III. surrendered at Sedan, he proposed the dissolution of the empire and took a prominent part in proclaiming the republic on September 4 of that year. In the new government he became minister of the interior, aided actively in resisting the capture of Paris by the German army, and during the siege escaped from the city in a balloon. After the capitulation of Paris, he still remained active, and refused to participate in the convention for the ratification of the peace treaty. His efforts were potent in reorganizing the republican party and a national force. In 1879 he forced the resignation of MacMahon as president, and the following year was elected president of the Chamber of Deputies. In 1881 he was selected premier and president of the council. The ultra radical reforms proposed by him ended his ministry in a few weeks. His death was the result of an accident from carelessly handling a revolver, from which he received a dangerous wound in the hand. Gambetta ranks as one of the most eminent public men of the present republic. He was held in universal esteem as a statesman.

GAMBIA (găm'bĭ-à), the oldest and most northerly British colony on the west coast of Africa. It has an area of 69 square miles. The surrounding sphere of influence tributary to Gambia comprises with it a colony and a protectorate of 4,130 square miles. Rice, cotton, corn, hides, beeswax, and rubber are exported. The district contains some exceedingly fertile tracts of land, though much is unproductive. As a colonial possession it is important mainly on account of commanding the Gambia River, which furnishes extensive means for interior navigation and trade. The government is administered through a local executive and a legislative council. Bathurst, situated on the island of Saint Mary, is the chief town and has 7,500 inhabitants. Only a comparatively few of the inhabitants are whites, about 200, and a majority of the natives are Mohammedans. A considerable missionary work has been done by the Christian churches. The slave trade was abolished in 1906. Population, 1922, of the colony, 13,945; of the protectorate, 240,000.

GAMBIA, an important river of Western Africa, rises in the mountains north of Liberia,

(Opp. 1093)

FAMILIAR GAME BIRDS.

Woodcock.
Canvasback Duck.
Mallard Drake.
Wood Duck.
Green Winged Teal.
Golden Plover.
Red Winged Teal.

flows in a northwesterly direction to the Atlantic, and has a total length of 725 miles. The estuary has a width of 25 miles some distance from its mouth, but at the place where its waters join the Atlantic it is only about two miles wide. The lower valley is overflowed in the rainy season, leaving rich alluvial deposits, which greatly enhance the annual productions. Vessels navigate the river for 650 miles from June to November, but large craft sail only about 90 miles inland.

GAMBLING (găm'blĭng), the practice of playing a game of chance for pecuniary profit. It was the custom in very early times to exercise some legal control over the sports and pastimes of the people, especially those involving an element of game or gambling. Certain games were reserved for people of the higher classes in society, or were prohibited altogether. In modern times legislation has been directed toward suppressing the games that are considered dangerous to life, as well as those in which gambling is made the direct object. *Betting* is a form of gambling and is prohibited in most countries, though prizes are permitted, such as those awarded to the winner in a foot race or to the successful side in a game of ball. The laws of England and the United States provide a penalty for those who keep a gambling house as well as for those who actually engage in gambling.

GAMBOGE (găm-bōōj'), a gum resin used in painting and for lacquer work. It is obtained from the gamboge tree, which is native to the East Indies and Southern Asia. It grows to a height of forty feet and has oval leaves, small flowers, and clusters of edible fruit. The gum resin is obtained by making an incision in the tree, when the gamboge exudes as a yellowish juice, and after exposure to the air becomes hard. It is collected in earthen vessels and left to thicken, or is poured when semifluid into the hollow joints of the bamboo, thus giving it the form of cylindrical sticks. The finer quality of gamboge is brittle and of a reddish-orange color, has no odor, and is acrid to the taste. Powdered gamboge has a bright yellow color. Several species of trees in Mexico yield gamboge, but the quality is inferior to that obtained from Asia.

GAME, the general name applied to birds and animals that are hunted for their flesh or for various commercial purposes. These animals are pursued and captured by some persons as a vocation and for purposes of recreation. *Game laws* have been enacted to regulate the hunting of game, otherwise many species of useful animals would be exterminated by useless destruction. At first legislation was directed more particularly to prevent hunting for a brief period during the breeding season, but now the laws are more stringent and either prohibit killing some animals at any time, or limit the hunting seasons to a short period each year. In some countries it is required that a license be taken out before any kind of game can be killed, while in others hunting under any circumstances is prohibited. The ruthless destruction of the buffalo and elk has exterminated them in the hunting grounds and they are found at present only in parks and reservations. Such animals as the quail, deer, duck, goose, brant, and grouse may be hunted only at certain seasons, depending upon the locality and the habits of the species.

Game preserves are grounds set apart for breeding and protecting of game. They are either private or public. Private preserves are very numerous in Europe, where the wealthy maintain them to breed and hunt useful species. Such estates are the property of the nobles, especially in Germany, Austria-Hungary, and Great Britain. Many large preserves are maintained in Canada and the United States, in which it is aimed to protect the primeval scenery as well as many species of game. The Roberval Club of Canada has a preserve of 500 square miles in the Laurentian Mountains, and the most notable government preserve of Canada is that of Henri Menier, which consists of the entire Anticosti Island, in the Gulf of Saint Lawrence. The Vanderbilt game preserve at Biltmore, N. C., is the largest private reservation of this kind in the United States. That country has many public reservations, such as the Yellowstone National Park, where animals and natural scenery are protected.

GAMES, a class of amusements or sports, played either as a pastime or to test physical or mental skill. Among many ancient peoples, especially the Greeks and Romans, it was customary to play games at regular intervals. These games were in the form of public exhibitions of skill and strength. Among the most popular modern games may be mentioned baseball, cards, croquet, tennis, billiards, football, etc. See **Athletics; Circus; Olympic Games.**

GANDHI, Mohandas Kramshand, national leader of India, born at Purbander, India, Oct. 2, 1869. He lived in England from 1888 to 1891, where he studied elocution and law. He is noted as an advocate of the independence of India, which he sought to secure by general noncoöperation with the British government.

GANGES (găn'jēz), one of the most important rivers of Asia, rises in Garhwal, at the western slope of the Himalaya Mountains. It is formed by the junction of the Bhagirathi and the Alaknanda rivers, at Deoprag, about ten miles east of Srinagar. The Bhagirathi is regarded a sacred stream by the natives, has its head 13,800 feet above sea level, and is considered the source of the Ganges, though a larger volume of water is brought from a great distance by the Alaknanda. Among the principal tributaries of the Ganges are the Jumna, Gandak, Son, and Kusi, though there are numerous other tributaries, while the Brahmaputra re-

ceives the main channel of the delta, called the Padna, or Padda, and the other streams of the delta flow into the Bay of Bengal. The lower basin constitutes the great valley of Hindustan. It contains much fertility and is one of the most important regions of Asia. Branches begin to flow out from the main stream about 225 miles from its mouth, forming a vast delta in the nature of level and waste swamps, through which many channels course and intersect each other at various points. The entire length is 1,550 miles and the basin drained embraces 395,000 square miles. The largest branches of the delta are the Hugli and the Meghna, the former being on the west side and the latter on the east, and these begin about 200 miles or more from the sea.

Among the principal cities situated on the banks of the Ganges are Cawnpore, Farruckabad, Bahar, Benares, Calcutta, Patna, Allahabad, and Murshedabad. Navigation extends a distance of nearly 1,250 miles from the Bay of Bengal, which makes it an important avenue for commercial and passenger intercourse, though within late years several railroad lines have been constructed in various directions through and along the valley. In the hot season of the year the volume of water is decreased slightly, while in the rainy season great floods cover the lower country, when the water extends over a region about one hundred miles wide. The floods recede about the middle of August, leaving rich alluvial deposits to greatly fertilize the soil. The river is held sacred by the Hindus, who either bathe in it or partake of its waters. From this custom a considerable industry has arisen, and the water is bottled and carried as an article of commerce to the remote interior districts. Bathing in the Ganges is considered necessary in order to exempt the dead from returning to the earth to recommence life anew. The Hindus think that those who partake of the water have assurance of eternal bliss. Throngs of pilgrims visit various points annually, especially at Allahabad, where a great fair is held periodically.

GANGES CANAL, an artificial canal of India, constructed to overcome the obstructions of the Ganges River above Allahabad. It was commenced in 1848 and cost about $25,000,000. The total length is about 700 miles, 400 miles of which are navigable, while the remainder and a large number of branches are used to irrigate the country which lies between the Ganges and the Jumna.

GANGLION (găn'glĭ-ŏn), in anatomy, an enlargement of the nerves, consisting of a small rounded or elongated nervous mass, usually of a reddish-gray color. Two kinds of nervous ganglia are recognized, those of the sympathetic system and those of the cranial system of nerves. They serve to strengthen nervous impulse, or act as centers for communication with distinct sets of nerves.

GANGRENE (găn'grēn), or **Mortification,** the loss of life in any of the soft parts of the body, without extinction of the vital powers in the rest of the organism. It is either partial or complete. In the former case it does not completely destroy the sensibility of the nerves, hence the local loss of action may be recovered, while in the latter it results in the death of a part. Gangrene is fatal in case it affects a vital part, such as the stomach, but amputation may be resorted to when it attacks a limb or an exterior wound. Modern methods of applying aseptic remedies have overcome the danger of gangrene in wounds, though formerly many deaths resulted from this cause.

GANNET (găn'nĕt), a web-footed bird related to the pelican and classed with the sea fowls. The bill is longer than the head, the beak is strong, and beneath the throat is a small pouch. The plumage is white, except the top of the head, which is yellowish, and some species have gray and black markings. Gannets swim well and have a powerful flight. They capture fish by plunging several hundred feet through the air, striking headlong downward to the surface of the water. They are migratory, passing from the Gulf of Mexico in the spring to breed on the northern coasts of the United States and in Southern Canada. In Europe they breed as far north as the coast of Norway and in autumn move southward to the Madeira Islands.

GANSEVOORT (găns'vōōrt), **Peter,** soldier, born at Albany, N. Y., July 17, 1749; died July 2, 1812. He joined the army at the beginning of the Revolution, serving as major of volunteers in a New York regiment. In 1776 he took part in the invasion of Canada, became lieutenant colonel, and was placed in command of Fort George. The following year he defended Fort Schuyler against a force of British under Saint Leger. Soon after he was made brigadier general in the New York militia and in 1809 received the same rank in the regular army. For a number of years he was commissioner of Indian affairs and military agent.

GANYMEDE (găn'ĭ-mēd), the youngest son of Tros, King of Troy, and celebrated as the most beautiful of mortals. While drawing water from a well at Mount Ida, he was observed by Zeus, who noticed his remarkable beauty and sent his eagle to transport him to Olympus, where he was endowed with immortality and appointed cupbearer to the gods. He is represented in statuary as a youth of exquisite beauty in form, short golden locks, delicate features, beaming blue eyes, and pouting lips.

GAPES (gāps), a disease common to fowls and other birds, due to parasitic worms. The gapeworm causes the bird to choke and induces inflammation. It may be removed, after treating the throat with spirits of turpentine, which is done by thrusting a moistened feather into

the windpipe. Mammals are affected by similar organisms lodging in the air passages, but their presence is not easily detected, hence no effective treatment can be given.

GAR, or **Gar Pike,** a fish of the ganoid family, found in the fresh waters of North America. It has an elongated body, is somewhat cylindrical in form, and is covered with bony scales. The teeth are sharp and set in the jaws of a prolonged bill. The garfishes range from Canada to Texas and live by preying upon other fishes. They are sometimes called *billfishes,* or *bony pikes,* and are not considered good for food. The marine garfishes are larger, from three to five feet long, and are widely distributed. They often leap high out of the water in pursuit of the flying fishes, which they pursue for food. These fishes are numerous in the Gulf of Mexico and the West Indies.

GARBAGE (gär'bāj), the discarded remnants of materials which accumulate in cities. Within recent years the authorities of the great centers of population have turned their attention to utilizing garbage in fertilizing and increasing the productiveness of the soil. In New York, Boston, Montreal, and other American cities these wastes are removed by vehicles. Usually they are classified as waste and usable, after which portions are utilized and the remainder is disposed of in a manner best calculated not to impair public health. In many of the cities of Europe garbage is transported by convenient and well-protected means to outlying districts, and, as a result, large areas of waste and unproductive lands have been reclaimed and rendered valuable. This process of utilizing offal and sewage has largely improved the sanitary conditions, lessened the liability of breeding trichinae in hogs fed with refuse matter, and tended to maintain the purity of the city water supply. Many cities maintain garbage furnaces, which were first installed in Great Britain, and they are utilized to burn the class of waste matters that are considered dangerous to public health. It is not difficult to realize how sanitary conditions may be improved by lessening the amount of decaying litter which is often found in cellars and other places throughout many cities. The garbage disposal of New York City, not including the ashes and light wastes, is esitmated at about 300,000 tons per year. In Chicago much of the garbage materials has been used in filling and grading, both in the low lands and in making land along the lake front.

GARCIA (gär'shĭ-ȧ), **Manuel,** singer and composer, born in Seville, Spain, Jan. 21, 1775; died June 19, 1832. He first appeared to good advantage as a singer at Cadiz and Madrid. In 1808 he obtained success at the Italian opera in Paris, and soon after appeared with equal favor in Rome and Naples. Later he sang in Berlin, Vienna, and London, and in 1825 visited the United States and Mexico, where he conducted a strolling company made up partly of his own family. After returning to Paris, he devoted himself to teaching singing and voice culture. His second daughter, Pauline Garcia, born in Paris in 1821, attained to high repute as a vocalist and operatic singer.

GARCIA Y INIGUEZ (gär-sē'ȧ ē ē-nē'gȧs), **Calixto,** Cuban patriot, born in Holguin, province of Santiago, Cuba, Oct. 14, 1838; died in Washington, D. C., Dec. 11, 1898. He descended from an excellent family, received a good education, and was trained for the profession of law. In 1868 he began a long career as a Cuban patriot by joining the revolutionary forces in the Ten Years' War. He was put in command of 150 men, with whom he took decisive action by driving the Spaniards from Holguin and other towns of Santiago. When the provincial government removed Maximo Gomez, Garcia became commander in chief. In 1873 he was captured by the Spanish forces, transported to Spain, and imprisoned in Valencia and Santona. In 1877 he was released and took up his residence in New York City, and in 1880 returned to Cuba to assist Antonio Maceo in an insurrection. However, he was soon after captured and taken to Madrid, where he remained in prison for fifteen years, during which time he taught French and English to young Spaniards.

In 1895 he escaped from Madrid and came to New York, where he enlisted men and secured arms and ammunition valued at $200,000 for service in the Cuban revolution of 1896. Shortly after he proceeded to Cuba and, after numerous campaigns, secured control of a large portion of the interior of the island. In 1898 he rendered valuable service to the United States army with a force of 4,000 Cubans, with whom he took part at the Battle of El Caney. He aided materially by reconciling the Cubans to the temporary occupation of the island by the United States forces. His death, which occurred shortly after Cuba was liberated, but before the wholesome effects of Spanish evacuation were realized, caused profound sorrow. His remains were taken to Cuba in the United States dispatch boat *Dolphin* for burial, accompanied by a large guard of Americans.

GARCILASO DE LA VEGA (gär-thē-lä'sō dȧ lä vȧ'gȧ), historian, known as the Inca, born in Cuzco, Peru, in 1540; died in 1616. He descended from a family of Spanish pioneers in Peru, and his mother was an Inca princess. In 1560 he went to Spain, where he took part in the wars against the Moors and Turks, and later retired to private life at Cordova. He translated several works from the Italian, including Abarbanel's "Dialogues of Love," and wrote a number of valuable historical works pertaining to America. The latter include "History of Florida" and "Royal Commentaries of Peru."

GARDA (gär'dȧ), a lake of Italy, the largest

in that country. It is 35 miles long, about 8 miles broad, and covers 190 square miles. The lake is fed by the melting of the Alpine snows and by the inflow of the Sarca River, and its surplus is conveyed by the Mincio to the Po River. It is a beautiful sheet of water and is traversed by numerous steamers. On its shores are many villas and towns, including Salò and Gardone-Riviera.

GARDEN CITY, a village in Nassau County, New York, about eighteen miles east of New York City, on Long Island, on the Long Island Railroad. It was laid out by A. T. Stewart as a model villa town, intended for residential purposes, and is beautified by numerous boulevards and avenues of trees. Among the buildings are a fine Gothic cathedral, a memorial school for boys, a female seminary, and other extensive structures. The Protestant Episcopal bishop of Long Island has his residence in Garden City. It is a popular residence of many New York business men.

GARDEN OF THE GODS, the name of a region in Colorado, near Colorado Springs. The name applies to a tract of 500 acres, remarkable for the grotesque forms of huge red and white sandstone, many of which bear local names, such as Seal Rock and Cathedral Spires. Near the entrance is the gateway, formed of bright red rocks fully 325 feet above the surrounding surface.

GARDINER (gärd'nĕr), a city of Kennebec County, Maine, at the junction of Cobbossee and Kennebec rivers, six miles south of Augusta, on the Maine Central Railroad. An abundance of water power facilitates the operation of numerous manufacturing establishments, including sawmills, machine shops, and flouring mills. It has a public library and a number of fine schools. Among the municipal improvements are electric lights, waterworks, pavements, and a system of sewerage. It was settled in 1760 and chartered as a city in 1849. Population, 1900, 5,501; in 1920, 5,475.

GARDINER, Samuel Rawson, modern historian, born in Hampshire, England, March 4, 1829; died Feb. 23, 1902. He graduated at Oxford, after which he was made professor of modern history in King's College, London. In 1885 he was elected fellow of All Souls', Oxford, for the purpose of pursuing advanced historical studies. While holding that position he devoted much time to writing and preparing extensive treatises in relation to the Civil War and the Commonwealth, and in the meantime edited public documents, family papers, and parliamentary debates. A civil pension was granted him in 1882 by the crown for having made valuable contributions to historical writings, and in 1894 he received the appointment as regius professor of modern history at Oxford. Among his writings are "History of the Great Civil War," "History of England from 1603 to 1642," "The Thirty Years' War," 'History of the Commonwealth and Protectorate," and "Cromwell's Place in History." His wife, Bertha Mariton Gardiner, published "The French Revolution."

GARDINER, Stephen, prelate and diplomatist, born at Bury Saint Edmunds, England, in 1483; died Nov. 12, 1555. He studied at Cambridge and became secretary to Wolsey. In 1528 he was sent to Italy to procure the consent of the Pope to the divorce of Henry VIII. from Queen Catherine. Though his mission proved unsuccessful, he rendered important service to Wolsey while in Rome.

GARDNER, a town of Massachusetts, in Worcester County, on the Otter River and on the Boston and Maine Railroad. The surrounding country is fruit growing and agricultural. An almshouse, the Levi Heywood Library, a home for the aged, and Crystal Lake Park are noteworthy. Among the manufactures are furniture, ironware, implements, clothing, and machinery. It was incorporated as a town in 1785. Population, 1925, 18,730.

GARFIELD (gär'fēld), a borough of New Jersey, in Bergen County, on the Erie Railway. It is located on the Passaic River, opposite Passaic, and is important as a shipping and manufacturing center. Among its chief industries are chemical works, machine shops, and cotton and woolen mills. It has electric lights, waterworks, and a considerable trade in merchandise. Population, 1920, 19,381.

GARFIELD, Harry Augustus, educator, son of James A. Garfield, born at Hiram, Ohio, Oct. 11, 1863. He studied at Princeton and Dartmouth and became a college teacher of history and Latin. In 1908 he accepted the presidency of Williams College. President Wilson appointed him fuel administrator in 1917.

GARFIELD, James Abram, twentieth President of the United States, born in Orange, Cuyahoga County, Ohio, Nov. 19, 1831; died Sept. 19, 1881. His father, Abram Garfield, came from Massachusetts ancestors, having descended from English Puritans who founded Watertown in 1630. In 1830 his parents moved to Ohio, settling in what is now known as the Western Reserve, where his mother was left a widow with four small children, of whom James was the youngest. His early schooling was obtained during the winter terms in the rural districts, but he made rapid progress by assistance from his mother, and enlarged his knowledge

JAMES A. GARFIELD.

by studious and constant reading. In 1848 he worked as a tow boy on the Ohio Canal, entered Hiram College in 1851, and graduated from Williams College, Massachusetts, in 1856. Soon after he returned to Hiram College as a teacher of Greek and Latin and became president of that institution in 1857. In 1859 he was elected State Senator as a Republican, to represent Summit and Portage counties, and in 1861 organized a regiment of his students and was given charge of a brigade in Kentucky. For marked bravery and superior skill he was promoted to the rank of brigadier general. Among the battles in which he served with distinction are Shiloh, Corinth, and Chickamauga. While serving in Alabama he was appointed chief of staff of the army of the Cumberland and later was made major general of volunteers.

At the request of President Lincoln he resigned his commission in the army on Dec. 5, 1863, and hastened to Washington to take his seat in Congress, to which he had been chosen fifteen months before. His career as a legislator was equally as brilliant as his military record. He was a member of the Committee on Military Affairs, and was chairman of the Appropriation Committee and of the Committee on Banking and Currency. In 1877 he served as a member of the electoral commission and in the same year was elected Senator from Ohio. The convention at Chicago, held in June, 1880, nominated him for President of the United States, and after a hard-fought contest, he secured the election, defeating W. S. Hancock. He served in the Presidency only four months, being shot by an assassin, Charles J. Guiteau, on July 2, 1881, while at the depot of the Baltimore and Potomac Railroad in Washington. After lingering in a weakened condition he died at Elberon, N. J., where he had been conveyed for medical treatment.

The remains were taken to Cleveland, Ohio, at which place an elegant monument was erected to his memory. This memorial, known as the Garfield Monument, is on an eminence in Lake View Cemetery and is 148 feet high. President Garfield was successful in every line of life and always showed a willingness to struggle for merit. However, his political career was marked by severe party opposition and charges of being connected with the famous Crédit Mobilier. His mind was cultured and he always stood for the observance of the law and the advancement of learning. His early success as a teacher led him to be popularly designated "the schoolmaster President."

GARIBALDI (găr-ĭ-bal'dĭ), **Giuseppe,** soldier and patriot, born in Nice, France, July 4, 1807; died in Caprera, June 1, 1882. His busy life was begun as a sailor. He obtained democratic views in politics by coming in contact with Italian liberals at various ports of Italy. In 1834 he joined the movement inaugurated by Mazzini in favor of Italian independence which proved unsuccessful and led to his condemnation to death, but he escaped to France. Later he went to South America to join the army of Uruguay, then fighting for independence. In his struggle in South America he showed much skill as a leader in privateering and while there married a Creole. In 1848 he returned to Italy for the purpose of aiding that country in the common defense against the Austrians. The following year he commanded the combined forces against France and Austria, but was eventually defeated, and sought safety in the United States. In 1854 he returned to Italy, where he purchased the small island of Caprera, off the north coast of Sardinia, on which he made his home. He again took up arms for Italian liberation in 1859, attaining the decisive victories of Marsala and Palermo, and assumed the dictatorship of Sicily.

GIUSEPPE GARIBALDI.

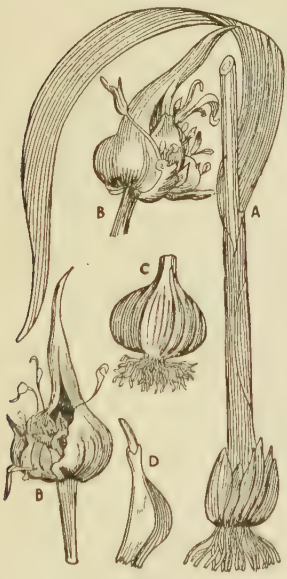
In September, 1860, Garibaldi with a force of volunteers captured Naples, which led to the fear that he would endeavor to attain power over all Italy, but he readily acquiesced in annexing Sicily to Italy, and again retired to private life on his island farm. In 1862 he commanded an unfortunate expedition against Rome, in which he was wounded and captured, but was released soon after. Subsequently he made a journey to England in the interest of Denmark, which proved successful. His last struggle for Italian independence occurred in 1866, when he was defeated at Mentone and held captive in Rome, but soon after escaped and returned in a boat to Caprera. In 1870-71 he aided the French against the allied German army. He became a member of the Italian parliament in 1875. Garibaldi, as a legislator, was radical, as a democratic thinker, studious, and as a republican leader, uncompromising in his efforts to secure Italian independence and the separation of the state from papal authority. There are few, if any, patriots in the history of the world who have been more devoted to the cause of country and more persistent in effort than he.

GARLAND (gär'lạnd), **Augustus Hill,** statesman and jurist, born in Covington, Ky., June 11, 1832; died Jan. 26, 1899. After securing an education, he was admitted to the bar of Arkansas in 1853, and in 1861 became a member of the provisional Congress of the Confederate States at Montgomery, Ala. He was

chosen a member of the first Confederate Congress and later became a Senator of the Confederate States. Though elected a Senator of the United States in 1867, he was not permitted to take his seat. In 1874 he became Governor of Arkansas and two years later Senator of the United States, serving from 1877 to 1885. President Cleveland appointed him Attorney-General of the United States in 1885, in which capacity he served until March, 1889, when he engaged in the practice of law in Washington, D. C.

GARLAND, Hamlin, author, born at La Crosse, Wis., Sept. 16, 1860. His family removed to Iowa and his home was at Hesper, a Quaker community, from which fact many of his tales relate to prairie scenes. He studied at Cedar Valley Seminary, Osage, Iowa, taught in the public schools of Indiana and Dakota, and in 1884 removed to Boston, where his literary career properly began. His first book was published in 1881, entitled "Main-Traveled Roads," for which William Dean Howells wrote an introduction. Other publications include "Wayside Courtships," "A Spoil of Office," "Her Mountain Lover," "Prairie Songs," "Ulysses Grant, His Life and Character," "Trail of the Gold Seekers," "Captain of the Gray Horse Troop," and "Up the Coule."

GARLIC (gär'lĭk), a perennial plant allied to the onion, composed of a compound bulb of ten or twelve smaller ones, called *cloves*. The plant has long pointed leaves, quite narrow and flat, and whitish or pinkish flowers, similar to those of the onion. It is indigenous to the southern part of Europe. In some countries it is cultivated extensively, especially in Portugal, where peasants eat slices of it with bread. Most species have a highly pungent taste and a disagreeable odor. In medicine it serves as a stimulant, expectorant, and diuretic, but its mildness renders it useful as a diet rather than as a medicine.



GARLIC.
A, Stalk; *BB*, Flowers; *C*, Bulb; *D*, Clove.

GARNET (gär'nĕt), a class of minerals, including various species that are prized highly. They occur usually in mica slate or in gneiss, but sometimes in limestone and granite, or in serpentine and lava beds. The three species of garnet which bring the highest prices are known as *alumina garnet, iron garnet,* and *chrome garnet.* These vary in color, such as red, brown, green, black, and yellow, according to the amount of coloring oxides contained in them. Some iron garnet contains enough metal to be attracted by the magnet. Garnets are found in Brazil, Peru, Ceylon, Bohemia, Siberia, and in many mountainous districts, the finest being the Syrian. Garnets which are transparent scarlet and crimson are known as *carbuncles.* A black variety is known as *melanite* and a green kind is called *demantoid.* Common garnet is often powdered and used for cutting and polishing other stone.

GARNET, Henry Highland, Negro clergyman, born a slave in Kent County, Maryland, in 1815; died in Monrovia, Africa, Feb. 14, 1882. He succeeded in reaching the northern states at an early age and engaged as a school teacher in Troy, N. Y. In 1842 he was licensed as a minister of the Presbyterian Church and served as pastor in Troy about ten years. He lectured on slavery in Europe from 1850 to 1853, engaged as a United Presbyterian missionary of Scotland to Jamaica, and shortly after returned to the United States. In 1855 he became pastor in New York City, where he won a large circle of friends. He was chosen president of Avery College in 1869. In 1881 President Garfield appointed him consul general to Liberia, where he died.

GARNISHMENT (gär'nĭsh-mẹnt), a process of attachment whereby a creditor levies upon money or property of his debtor in the possession of a third person. By this process such property is held subject to the payment of a debt, and advantage may be taken of it at the time of beginning a cause or after a judgment has been rendered. The person who is notified to hold such property subject to the order of the court is called a *garnishee.* This process is commonly used in cases where the wages of a debtor are seized to secure payment of a debt.

GARONNE (gȧ-rọn'), a river in the southwestern part of France, rises in the Pyrenees at an altitude of 6,142 feet above sea level and flows toward the northwest, discharging into the Atlantic. It receives numerous tributaries, among them the Save, Lot, Baise, Ratz, and Dordogne, and, after forming a junction with the last-mentioned, is called the Gironde, a distance of about fifty miles, where it constitutes an important estuary. The basin of the Garonne includes 22,050 square miles, is fertile, and contains numerous thriving commercial centers. The Central Canal joins the Garonne at Toulouse and unites it with the Mediterranean Sea, thus forming an important connection between that and the Atlantic. Several other canals join it, one of which crosses the river at Agen by a viaduct.

GARRETT, John Work, financier and railroad president, born in Baltimore, Md., July 31, 1820; died Sept. 26, 1884. He was interested in railroad enterprises and steamboat navigation, serving as president of the Baltimore and Ohio Railroad from 1858 until his death. His son, Robert Garrett, was born in Baltimore, April 9, 1847; died July 29, 1896. He held various offices in the railroad system established by his father, and after the death of the latter succeeded to the presidency. His mind became partially unbalanced on account of the reverses following the purchase of the Baltimore and Ohio telegraph lines by Jay Gould. His sister, Mary Elizabeth, became known as a philanthropist and promoter of higher education among women. She donated liberally to Bryn Mawr College, and in 1892 aided in establishing a medical college in connection with Johns Hopkins Hospital by giving about $300,000.

GARRICK (găr'rĭk), **David, actor and** dramatist, born in Hereford, England, Feb. 20, 1716; died Jan. 20, 1779. He was educated at the grammar school of Lichfield. In 1735 he took a course of six months under Samuel Johnson, and shortly after both teacher and pupil settled at London. Garrick studied law and engaged as a wine merchant, but soon after went upon the stage and began to play as a professional actor in 1741. His early successes caused him to appear in London, where he played successfully in the character of *Richard III.*, and soon after attained success by attracting the attention and applause of large audiences. He became manager of Drury Lane Theater in 1747, two years later married Mlle. Violetti, an actress from Vienna, and continued to direct the Drury Lane entertainments until he retired from the stage in 1776. A trip to Italy in 1763 was the only vacation period taken from his busy field of labor. Garrick ranks as one of the most noted English actors.

GARRISON, Lindley M., public man, born at Camden, N. J., Nov. 28, 1864. His father, Joseph F. Garrison, was an Episcopal clergyman. He acquired a liberal education and became a successful lawyer. In 1904 he was made vice-chancellor of New Jersey and was reappointed for a term of seven years in 1911, but resigned in 1913 to enter the Cabinet of President Wilson as Secretary of War. He resigned this office in 1916.

GARRISON (găr'rĭ-sŭn), **William Lloyd,** journalist and abolitionist, born in Newburyport, Mass., Dec. 10, 1805; died in New York, May 24, 1879. He was apprenticed to a shoemaker at Lynn in 1814, but soon after entered school at Newburyport, where he worked out of school hours to pay his expenses. He commenced to learn cabinetmaking in 1818, but some time after engaged as printer on the Newburyport *Herald,* and when only sixteen years old began to arouse interest by writing on the slavery question. He became editor of the *Herald* in 1824 and was among the first to publish poems from the pen of Whittier. Later he edited the *Free Press,* and in 1827 conducted the editorial work on the *National Philanthropist,* the first temperance journal published in America. In 1829 he aided in organizing the *Genius of Universal Emancipation,* a periodical issued at Baltimore, in which he denounced the slave trade in such outspoken words that he was imprisoned for libel. After being released, he went on the platform as an antislavery orator, founded the *Liberator* in 1831, and the next year established the American Anti-Slavery Society, of which he afterward became president. He visited European countries on a lecturing tour, where he was welcomed by many of the liberal thinkers. His "Thoughts on African Colonization," published in 1832, extensive lectures, and editorial work had a marked influence upon public opinion regarding slavery. The principles advocated by him rapidly gained in popularity until in 1865, when slavery was abolished and the Anti-Slavery Society dissolved. His friends presented him with $30,000 in recognition of valuable service. A number of poems and selections were published by him.

WILLIAM LLOYD GARRISON.

GARROTE (găr-rŏt'), a method of execution practiced by the Spaniards. It is a form of strangulation and was originally performed by placing a heavy cord around the neck of a criminal, who was seated on a stool fastened to a stake, and the cord was twisted by inserting a stick between the rope and the back of the neck, then twisting until strangulation took place. Another method was by means of a brass collar placed around the neck, and pressure was obtained by means of a screw. The garrote was used extensively during the Inquisition. The name is sometimes applied to a species of robbery in which the victim is surprised by the highwaymen, who produce temporary strangulation by drawing a cord or handkerchief about the neck, when the pockets are rifled.

GARTER, Order of the, one of the most celebrated and ancient orders of knighthood. It was probably originated by Edward III, about Jan. 18, 1334, and served to reward the distinguished military personages who assisted in the struggle against France, though its founding is sometimes assigned to Richard I. It is related that Edward III. was dancing with the

Countess of Salisbury when her garter dropped, and, after putting it around his own leg, restored it with the expression of "Dishonored be he who thinks evil of it," which was afterward changed slightly to form the motto of the organization. Numerous revisions of the statutes of the order were effected in the reigns of Henry V., Henry VIII., Edward VI., and in 1805 under George III.

Originally there were 26 knights, inclusive of the sovereign, who was the recognized head. The statute passed in 1786 recognized and maintained this number, but admitted as supernumerary members certain of the princes. The common title of the order was *Order of Saint George* prior to the reign of Edward VI., and the same term is still applied synonymously with that now used. A dark blue ribbon, edged with gold, is used to represent the garter as the emblem. On it the motto appears, *Honi soit qui mal y pense* (Shame to him who thinks evil), together with a buckle and pendant. It is worn below the knee of the left limb. However, there are other marks of distinction, such as a hood, mantle, gown, plume, star, ribbon, golden collar, and a figure of Saint George on horseback in contact with the dragon. The members use the initials K. G. to designate the order, which are written after their names. From some authorities we learn that ladies were members prior to the reign of Edward IV. The Prince of Wales is a member by virtue of his title.

GARTER SNAKE, the name applied to various small snakes of North America. The common garter snake is found widely distributed from Mexico to Canada, but in appearance the species vary somewhat. Most of them are brown or black, and those of the warmer section have spots or crossbars, while the species common to the colder regions are striped with greenish color.

GARY, a city of Lake County, Indiana, 22 miles south of Chicago, on the Pennsylvania, the Wabash, and other railroads. It has extensive foundries, machine shops, cement works, steel and iron industries, car shops, and gas and locomotive works. The features include the public library, the Froebel School, the Palace Theatre, the post office, the Gary-Alerding Settlement House, and many schools, churches, and hospitals. It was settled and incorporated in 1906. Population, 1920, 55,378.

GARY, Elbert Henry, capitalist, born at Wheaton, Ill., Oct. 18, 1846; died in New York City, Aug. 15, 1927. After serving as mayor of Wheaton and as county attorney in Chicago, he became a steel manufacturer and ultimately head of the United States Steel Corporation with the seat of activities at Gary, Ind.

GARY, James Albert, business man, born in Uncasville, Conn., Oct. 22, 1833; died Oct. 31, 1920. President McKinley appointed him Postmaster-General in 1897, but he resigned the office in 1898, being succeeded by Charles E. Smith.

GAS, one of the three forms of matter, the other two being *solids* and *liquids,* and which constitutes a fluid that cannot be liquefied nor solidified at ordinary temperatures and pressure. Air was practically the only gas known to the ancients, but artificial gas was referred to as *spiritus* by writers as early as the 14th century A. D. The term gas soon came to be applied to all elastic fluids that differ from common gas, and which were thought to be permanent. However, Faraday liquefied various gases by reducing the temperature and increasing the pressure, and since then the term has been applied generally to all substances in an elastic aëriform state. Experiments in liquefying gases have established the fact that none is permanent, and that even air may be reduced to a liquefied state, this being first demonstrated in 1878. To reduce a gas to a liquid state it is necessary to make application of cold or pressure, or a combination of both. The point at which the distinction between a gas and a liquid is lost is called the *critical point of temperature,* and there is a particular temperature for any given pressure at which the critical point of temperature can be reached. It is only at or below this particular temperature that pressure converts a gas into a liquid.

Gases are generally distinguished from liquids by the term *elastic fluid,* while liquids are termed *nonelastic fluids,* this being due to the circumstance that liquids have comparatively little or no compressibility. Though all liquids have elasticity, they expand after compression is removed to their former state, while gases expand to an indeterminable extent and in every direction when left unconfined. As a general rule the density of a gas depends upon the pressure to which it is subjected, or, in other words, an increase of pressure reduces the volume of gases proportionally. This is in accord with the law announced by Edme Mariotte (1620-1684), a French physicist, which is substantially as follows: *The volume of a given mass of gas varies inversely with the pressure to which it is subjected.*

Two or more gases brought into contact mix in any proportion and diffuse themselves uniformly regardless of their gravities. This may be verified by filling a bottle with hydrogen and another with oxygen, whose specific gravity is sixteen times that of hydrogen, or with carbonic acid, whose density is twenty-two times as great, and connecting the two bottles with a glass tube about ten inches long. Diffusion of the gases will begin at once, and within a few days they will be found to have the same proportion to each other in both bottles, even if a porous substance, as a thin membrane, be placed in the tube. The kinetic theory of gases accounts for the power of motion inherent in all parts of aëriform matter. According to it a

gas consists of molecules sparsely distributed through space, but which move about with much velocity. An increase of temperature has the effect to greatly increase the molecular energy, when the pressure within the vessel will be increased correspondingly, while lowering the temperature has an opposite effect.

Gas is a valuable agent in lighting, heating, and for various other purposes in the arts and industries. Large quantities are derived from natural sources, but the greater supply is obtained from coal, wood, resin, peat. water, coke, oils, and fats. In many localities gas issues from the surface of the earth, as in Pennsylvania, Texas, Ohio, New York, and various parts of Eurasia, especially at Baku, and is now used very extensively for illuminating and heating purposes. The Chinese have utilized gas for centuries in various industries and even transported it to different parts of their own country, which they did in ancient times by confining it in bamboo tubes. It may be said that the artificial manufacture of gas in Europe dates from 1739, when an inflammable gas was obtained in England by subjecting coal to heat in a closed vessel and conducting the fluid through a small tube into bladders. A simple experiment consists of placing particles of bituminous coal in the bowl of a tobacco pipe, then closing the top with moist clay and heating to a red heat. When reaching the point of distillation, a yellowish smoke issues from the stem of the pipe, which yields a bright flame when lighted.

In the manufacture of coal gas the coal is placed in an iron or clay retort, in which it is heated until it expands to twice its bulk and forms coke, while the gas generated is conducted by a pipe into a receiver. The tanks used in factories have a large capacity, some having storage room for 3,000,000 cubic feet of gas. In distilling the coal it gives off heat, steam, ammonia, tar and gas. The ammonia and tar are run off into cisterns, while the gas is passed over lime before running it into gas storage tanks for the purpose of freeing it from acids.

In an analysis made by Robert W. Bunsen (q. v.) it was found that the products of the destructive distillation of bituminous coal include the following: Coke, sixty-eight per cent.; tar, twelve; water, eight; marsh gas, seven; carbonic oxide, one; and carbonic acid, one. In addition to these are generated small quantities of olefiant gas, hydrogen, ammonia, and nitrogen. Coal gas is used largely for heating and lighting, and for that purpose is passed to houses and factories by pipe lines. Small pipes carry the gas to lamps and burners in different parts of the buildings. A gas meter, through which the gas passes, is usually in each building, and the quantity consumed is measured quite accurately.

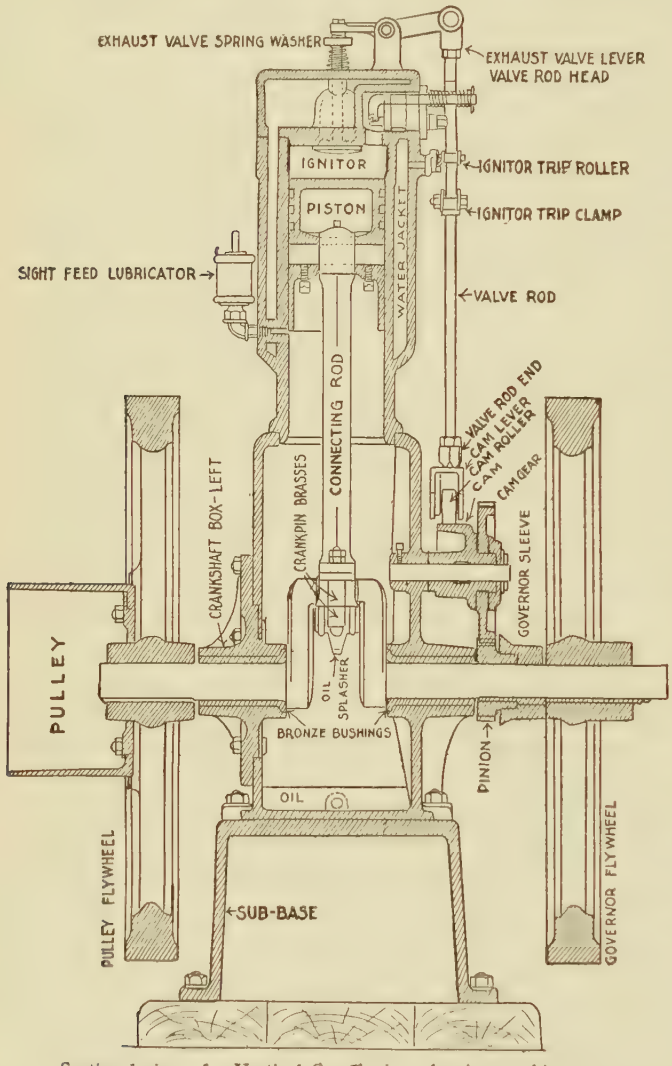
Wood gas contains more illuminating power than olefiant gas and its specific gravity is greater than coal gas, hence, it requires burners with larger orifices. *Resin gas* has a high illuminating power, but the supply is necessarily limited. *Peat gas* is distilled in retorts similar to those used in wood gas. *Water gas* is made by forcing steam and the vapor of crude petroleum into retorts, which are subjected to a high temperature. This product is cheaper and more satisfactory for illuminating than coal gas. *Oil gas* is obtained by dry distillation, or by running oil or petroleum through tubes which have been raised to a red heat. This gas, stored in cylinders and subjected to pressure, is used generally in lighting railway cars. Crude petroleum is used extensively in making gas for illuminating purposes. See **Natural Gas; Acetylene.**

GASCONADE (găs-kŏ-nād′), a river in Missouri, rises in Wright County, and flows in a general course toward the northeast. It discharges into the Missouri River at Gasconda, about 35 miles below Jefferson City, after a course of 250 miles. The basin includes a large portion of the slopes of the Ozark Mountains and the course of the river is quite tortuous.

GASCONY (găs′kŏ-nĭ), or **Gascogne,** a former duchy in the southwestern part of France. It was bounded by the Bay of Biscay, the Pyrenees, and the Garonne River, corresponding to the present departments of Gers, Landes, and Hautes-Pyrénées and portions of four other departments. The inhabitants were generally known as Gascons, who descended from the Goths and the Basques. They submitted to the Franks in 1602, but maintained a semi-independent government, and later were conquered by Pepin. The region was a possession of England from 1152 until 1453, when it was reconquered by France.

GAS ENGINE, an engine in which the motion of the piston is produced by the combustion or sudden production or expansion of gas. Machines of this kind now in extensive use receive their motion by an explosive mixture of gas and air being forced into the working cylinder and ignited there by a gas flame or an electric spark. The largest number are *gasoline engines,* in which gasoline gas produces the motion, but natural gas, illuminating gas, and gas from naphtha or other petroleum products are employed. These engines vary in construction and efficiency, ranging from very small machines to those having a capacity of 650 horse power. Besides having valves for the admission and escape of gas from the cylinder and igniting apparatus, they possess the essentials of the steam engine, having a piston within the cylinder, a connecting rod, a crank, and a fly wheel. Motion is induced by admitting gas into the cylinder, where it is exploded by an electric spark, causing the piston to be thrown forward, which acts to cause a partial vacuum within the cylinder, into which more gas is

admitted, which, on being exploded, causes another forward movement of the piston. The burned gas escapes at the return of the piston, when the exhaust valve is thrown open. The movement would be irregular and ineffective without a fly wheel, which moves rapidly and maintains uniformity in the rate of speed. The inflow of gas, as the intake valve is thrown open, is regulated by a governor attached to the



Sectional view of a Vertical Gas Engine, showing working parts.

fly wheel. Gas engines are used extensively where power is required periodically, especially in such structures as motor bicycles, automobiles, hoisting machines, yachts, etc.

GASKELL (găs'kĕl), **Elizabeth Cleghorn,** novelist, born in Chelsea, England, Sept. 29, 1810; died Nov. 12, 1865. In 1832 she married William Gaskell, a Unitarian minister. Her writings include "Mary Barton," "Wives and Daughters," "Round the Sofa," and "Life of Charlotte Brontë."

GASTONIA, a city of Gaston County, North Carolina, on the Southern and other railways. It has paving, sanitary sewers, electric lights and railways, cement works, and cotton manufactures. The features include the federal building. It was settled in 1873. Population, 1920, 12,871.

GASTRIC JUICE (găs'trĭk), a colorless liquid secreted by the stomach, containing 98.5 per cent. of water. It has a salty, acid taste, the active principle being pepsin. The function of gastric juice is to dissolve the nitrogeneous elements of food, such as albumen, fibrin, and casein. It affects portions of the vegetable food and all animal food, except fat, converting them into what is known as *peptones.* The acid in some cases seems to be largely of a hydrochloric nature. In others hydrochloric and lactic, or even butyric and acetic acids are present, but they are thought to be due to the change undergone by the food in the process of digestion. When the food has been thoroughly mixed with the liquid of the stomach, it is known as *chyme,* which passes into the intestines as a thick but sticky substance. About fourteen pounds of gastric juice are secreted daily in the human adult. Artificial gastric juice can be made by extracting pepsin from the coat of the stomach of animals by means of glycerin, and adding water to the filtered liquid, with a small per cent. of hydrochloric acid.

GASTRITIS (găs-trī'tĭs), an inflammation of the stomach, especially of the mucous membrane of that organ. The early symptoms include a pain in the stomach and a severe headache, which are usually followed by fever and nausea. A common form is known as acute catarrhal gastritis, which is usually due to careless dieting. Toxic gastritis is caused by an excessive use of stimulants, especially alcohol. An acute and persistent form is known as chronic gastritis, which causes a general decline of health. Wholesome exercise and careful dieting are recommended in all forms of this disease.

GASTROPODA (găs-trŏp'ŏ-dà), a class of mollusks that have a distinct head, bearing eyes and tentacles, and movement is by means of a

large creeping disk or foot. In most species the body is not symmetrical, but the head and foot are usually well formed. All the species have a more or less clearly defined hump upon the back, which is extended in some to a considerable size, and in it are contained the visceral masses, including the stomach, circulatory organs, and the glands of reproduction. The shell is single or univalve, usually coiled in a spiral. The greater number of mollusks with univalve shells belong to this class, but it also contains some species with multivalve shells, such as the chitons. Among the species of gastropods are the limpets, snails, slugs, and cowries.

GATES, Horatio, American general, born in England in 1728; died in New York City, April 10, 1806. In 1755 he came to America, serving as captain in Braddock's expedition, and was severely wounded in the engagement that followed. In the early Revolutionary movements he became a prominent factor for American independence, when he was appointed adjutant general in the colonial army, and gained a decisive victory over the British at Saratoga in 1777. This success was followed by the surrender of Burgoyne, and is classed by Edward S. Creasy (q. v.) as one of the great battles treated in his "Fifteen Decisive Battles of the World." Though he managed the campaign with much ability, at least a part of the glory belongs to Schuyler. Shortly after he became implicated in the Conway Cabal, whereby he hoped to secure general command of the colonial army, a position held by Washington. The design was discovered and he was relieved of his command until 1780, when he was made a commander of the Southern forces and sustained a severe defeat at Camden, on August 16. This led to his retirement, and a court-martial, after investigating his conduct, did not acquit him from blame for the defeat until in 1782. In 1784, after freeing his slaves, he settled in New York City, where he resided until his death.

GATES, Sir Thomas, Colonial Governor, probably born at Colyford, England; died about 1621. He entered the army at an early age, but little is known of him until 1609, when he was named in the second charter of Virginia. It is certain that he promoted the organization of the Virginia Company and that he saw active military service in the Netherlands. In 1609 he sailed as first Deputy Governor of Virginia with 500 colonists for America, but was wrecked on the Bermudas, where two vessels were constructed to enable the colonists to proceed. They left the Bermudas in 1610 and reached Jamestown, Va., in May, when the colony was short of provisions. The colonists became dissatisfied and induced Gates to return to England, but at the mouth of the James River they were met by Lord Delaware, who became Governor of the colony. In the same year Gates went to England to obtain recruits and supplies, and returned with 300 colonists in 1611. He remained in Virginia until 1614, when he returned to England.

GATH, one of the five chief cities of Philistia, frequently mentioned in the Bible in connection with David and the Jews. Goliath, who was slain by David, lived in Gath. It was alternately independent or under the power of the Jewish Kings, except for the short period when it was under Syrian rule. The Philistines defended it against David and Solomon, and it still remained a center of influence until the time of Jerome. It is not known where Gath was, but it is thought to have been located between Ashdod and Ekron.

GATINEAU (gä-tê-nō'), a river in the province of Quebec, Canada, the largest tributary of the Ottawa. It has its origin in a number of lakes, flows in a general southerly direction, and enters the Ottawa River about a mile below the city of Ottawa. It receives a number of tributaries and is about 400 miles long. Only a short distance is navigable, but it is utilized extensively in rafting timber and lumber.

GATLING (găt'lĭng), **Richard Jordan,** inventor, born in Hertford County, North Carolina, Sept. 12, 1818; died Feb. 26, 1903. He turned his attention to inventions at an early age, completing a screw for propelling steamers in 1838 and later a seeder for sowing wheat and rice. In 1850 he invented a hemp brake, a steam plow in 1857, and later a machine for transmitting power by means of compressed air. His invention of the revolving battery that bears his name is the most noted of his productions. It consists of a number of breech-loading rifled barrels constructed to revolve around a common center. Cartridges are supplied by an ingenious device, making it possible to fire 1,200 shots per minute from a ten-barreled gun. The United States adopted it in 1866, and it has since been used by several European governments. Among his more recent inventions are a torpedo and gun boat, an improved method for casting large steel cannon, and a superior pneumatic gun for discharging high explosives.

GATSCHET (gä-shā'), **Albert Samuel,** philologist and ethnologist, born in Saint Beatenberg, Switzerland, Oct. 3, 1832; died March 16, 1907. He first studied in Neuchâtel and afterward at the universities of Bern and Berlin, and spent some time in a research of the etymology of Swiss dialects. His investigations led to the publication of a work in German entitled "Research of Rock Ethnology." He removed to the United States in 1868 and served as editor of various German newspapers, and in 1877 was appointed ethnologist of the government geological survey. In 1874 he began an extensive study of the languages of the Indians, for which purpose he visited settle-

ments of native tribes in different sections of the country. For some time he was connected with the Smithsonian Institution. His publications include "Indian Languages of the Pacific States and Territories and of the Pueblos of New Mexico," "Twelve Languages of the Southwestern Part of North America," "Liberality of Aboriginal American Literature," "Analytical Report of Indian Dialects Spoken in Southern California, Nevada, and on the Lower Colorado River," and "People and Language of the Timucua Tribes."

GAUCHOS (gou'chŏz), the name of a nomadic class of people in South America, confined largely to Argentina and the Pampas in the basin of the La Plata River. They descended from whites and Indians, are tall and handsome, and engage chiefly in stock raising. They are skilled in using the lariat. The Gauchos are good horsemen and are independent and warlike.

GAUGE (gāj), or **Gage,** the name of many instruments used in the mechanical arts. The distance between the inner sides of the rails of a track is known as the gauge of railways and to ascertain it an instrument known as a *gauge* is used. It serves to set the rails to the proper space apart and to measure the distance when the rails require adjustment. An instrument known as a *steam gauge* is fixed to the boilers of engines, serving to register the force of the steam. It consists of a cylindrical box of metal furnished with a dial and the force is indicated by a needle, which is moved by a spring according to the pressure of the steam, which acts through a tube upon a movable piece of metal attached to the spring. The spring is compressed according to the pressure of the steam, and the needle indicates on the dial the pressure per square inch in pounds. A *water gauge* is one to indicate the level of the water in a boiler. It consists of a vertical glass tube, which communicates at both ends with the boiler, hence the water in the tube will rise to the same level as that in the boiler. Some boilers are provided with *gauge cocks* in addition to the vertical gauge.

GAUL, or **Gallia,** the name applied anciently to the country situated between the Rhine and the Pyrenees, which was the region occupied chiefly by the Gauls, the most numerous branch of the original Celts. The principal divisions of the region consisted of the district on the Roman side of the Alps and the one beyond the Alpine Mountains. In the course of time the former became known as *Gallia Cisalpina,* and the latter as *Gallia Transalpina,* though each was variously modified in extent by the fortunes of war and insurrectional disturbances. The Gallic people were first brought into history about 397 B. C., when they crossed the Alps and engaged in a series of wars with the Etruscans and Romans. In 390 B. C., they inflicted a defeat upon the Romans at Allia, burned a large part of Rome, and planted their authority far toward the East.

In 280 B. C., the Gauls conducted successful compaigns into Greece, penetrated across the Hellespont into Asia Minor, and made important settlements under the name of Galatians, with which the early Christian teachers came in contact. Their foothold along the Danube was lost as a result of the conquest of the Germanic peoples, who occupied the entire region tributary to the Rhine. The Cisalpina Gauls were prominent factors in contending against Roman power until the first Punic War, when an armed conflict of six years' duration compelled them to submit to the Roman authority, in 220 B. C. The march of Hannibal across the Alps to reduce Rome gave them an opportunity to again rise with prospects of success, but, when the Carthaginians were defeated by the Romans, the Gauls were again reduced to submission. A Roman invasion in 128-122 B. C. reduced and made them tributary, the Romans establishing Provincia, a name since perpetuated as Provence. Later the successful incursions of Germanic and Cimbrian armies tended still further to reduce the Gallic tribes, and they were ultimately subdued by the Romans in a war lasting nine years, conducted under the proconsulship of Julius Caesar, from 58 to 50 B. C.

GAUR (gär), or **Gour,** a wild ox native to Southern Europe, found chiefly in India. It stands about five feet high at the shoulders, has strong and much curved horns, and is one of the largest species of the ox tribe. The color is brown or blackish, except the legs below the knee, which are white. The hide is very thick and is used in making shields.

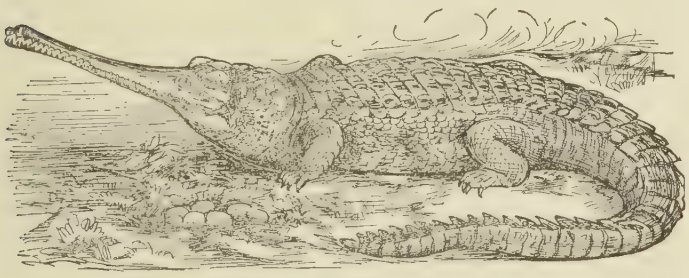
GAUTIER (gō-tyā'), **Theophile,** poet and novelist, born at Tarbes, France, Aug. 31, 1811; died Oct. 23, 1872. He studied at the College of Charlemagne and became an artist, but soon gave attention to literature. In 1830 he published a volume of poems written in the style of the romantic school, with which he was classed. He became editor of the *Journal Officiel* in 1869, in which he published many literary criticisms. The style of his writings is clear and interesting. Among his works are "Journeys in Spain," "Handsome Jenny," "Captain Fracasse," "Enamels and Cameos," and "History of Dramatic Art in France."

GAVARNI (gä-vär-nē'), the assumed name of Sulpice Paul Chevallier, artist and caricaturist, born in Paris, France, Jan. 13, 1804; died Nov. 24, 1866. He began the study of architecture at an early age and took up the work of mechanical drawing. In 1828 he received orders to draw illustrations for several periodicals at Paris. In the meantime he illustrated a number of works for Balzac and other writers, including Sue's "Wandering Jew." For several years he contributed caricatures to the *Charivari* in Paris. In 1847 he went to London, where he received employment and at the same

time contributed to periodicals in France. Few caricaturists have excelled him in ability to amuse the public with humorous drawings which illustrate important political events or personages.

GAVAZZI (gȧ-vät'sē), **Alessandro,** patriot and evangelist, born in Bologna, Italy, March 21, 1809; died in Rome, Jan. 9, 1889. In 1825 he entered the order of Barnabites and became professor of rhetoric in the University of Naples, where he gained a reputation as an orator. Soon after he was made chaplain general of the liberal forces by Pope Pious IX. Later the Pope joined the reactionaries and recalled the Roman legion from Vicenza, which caused Gavazzi to seek safety in Genoa. When the republican government was established, the Pope fled from Rome and Gavazzi returned, but escaped to London when the French captured Rome in 1842. While in England he lectured against Romanism. Subsequently he visited the United States and Canada, where his orations against the Roman government gave rise to numerous riots. In 1860 he joined Garibaldi in his efforts to establish the Free Church in Italy, revisited England in 1870, and made an extensive tour of the United States in 1873. Among his publications are "Recollections of the Last Four Popes," "New Union with Rome," and "The Priest in Absolution."

GAVIAL (gā'vĭ-ạl), or **Gharial,** a species of crocodile native to Southern Asia, found chiefly in the region of the upper Ganges and its tributaries. It is peculiar for its long and narrow jaws, which have numerous sharp and slender teeth. The food consists principally of fish and small reptiles. An adult gavial is about twenty feet long. The male has a large hump upon the snout, formed of cartilage, and in this the nostrils open. Though closely allied to the crocodile and alligator, it has a much narrower and feebler jaw.



GANGES GAVIAL.

GAY, John, poet and dramatist, born in Devonshire, England, in 1685; died Dec. 4, 1732. He descended from an ancient family, was apprenticed to a London silk mercer, and in 1711 published a descriptive poem dedicated to the Pope. Among his productions are numerous operas, sonnets, and oratorios, the most celebrated being the "Beggar's Opera," which was given 63 nights consecutively with excellent effect. Among other productions are "Wife of Bath," "Three Hours After Marriage," "Black-Eyed Susan," and "Polly." His works were not only popular, but brought good returns to the author, "Polly" alone netting him $6,000.

GAY, Sidney Howard, journalist and author, born in Hingham, Mass., in 1814; died June 25, 1888. He studied at Harvard University, but left that institution before graduating, and for some time worked in an accounting house in Boston. Later he studied law and engaged as a lecturer for the American Anti-Slavery Society. Subsequently he took up editorial work as writer on the New York *Tribune* and later on the Chicago *Tribune.* In 1872 he became a member of the editorial staff of the New York *Evening Post.* He assisted William Cullen Bryant in writing "Life of James Madison" and independently published "A Popular History of the United States."

GAY-LUSSAC (gā lü-sȧk'), **Louis Joseph,** chemist and physicist, born at Saint Léonard, France, Dec. 6, 1778; died May 9, 1850. He studied at the Polytechnic School, Paris, and became an assistant to Berthollet in the government chemical works at Arcueil. In 1804 he made two famous balloon ascensions to observe the variation in altitude with magnetic intensity, attaining to the height of 23,000 feet, and in the same year demonstrated that oxygen and hydrogen unite to form water in the proportions by volume of one of the former to two of the latter. From this discovery it was ascertained that gases combine uniformly in definite proportions by volume. In 1805 he accompanied Humboldt on a scientific tour through Southern Europe, and subsequently published a series of useful reports of numerous discoveries in chemistry. He was awarded many medals and received honors from numerous scientific and educational associations. The results of his discoveries were published by him in *Annals of Chemistry,* of which he was joint editor for nearly thirty years.

GAZA (gā'zȧ), a town of Syria, three miles from the Mediterranean, and fifty miles southwest of Jerusalem. It occupies an important position on the caravan road between the desert and the Mediterranean, hence has been important as a trade center from remote antiquity. The Egyptians were an important factor in extending its commercial influence, but it was conquered by the Philistines and became their most important city. Alexander the Great captured it after a siege of two months, in 332 B. C., and its final destruction, which occurred in 96 B. C., is referred to in Acts viii., 26. The

Romans rebuilt it, but it was more distinctly a Greek city, and for a long time rivaled Athens and Alexandria in culture. Omar captured and destroyed it in 634, but it was rebuilt by the Crusaders and defended by the Templars. The modern city is known as Ghazzeh. It has a considerable trade, but the buildings are poorly constructed. It was captured by the British under General Allenby in 1917. Population, 1922, 37,280.

GAZELLE (gȧ-zĕl′), the type of antelopes, including about twenty species, most of which frequent desert and mountain regions. They are found mostly in North Africa, Persia, and Arabia. The various species are gentle in disposition, light fawn colored, and have lustrous eyes. Both sexes have horns. The gazelle is preyed on by the lion and hunted for its flesh and hide. Though gregarious in habits, they are shy and difficult to approach. The *admi,* or mountain gazelle, is a familiar species of the Sahara highlands. Other well-known species include the *dama* of the Sudan, the *Loder's* of Algeria, and the *common gazelle* of Arabia.

GAZELLE.

GEAR, John Henry, statesman, born in Ithaca, N. Y., April 7, 1825; died July 14, 1900. In 1838 he removed to Iowa, engaged in business at Burlington in 1843, and became mayor of that city in 1863. Subsequently he was elected to the General Assembly of the State three different times, and served as speaker of the House two terms. In 1878-82 he was Governor, being elected as a Republican. He was elected to Congress in 1886, to which position he was reëlected in 1888 and 1892. On account of his eminent service in the House, he succeeded to the election of United States Senator in 1895. He was reëlected to the Senate in 1900, but died before entering upon the service of the second term, and was succeeded by J. P. Dolliver.

GEARING (gēr′ĭng), the name applied to a set or system of wheels in machinery, constructed so motion is communicated from one part of the machine to another. A gearing usually consists of a train of friction wheels, screws, or toothed wheels, and frequently of a series or combination of them. A machine is said to be *out of gear* when all parts are not adjusted for communication and *in gear* when it is set ready for use. The velocity of a machine depends upon the construction of its gearing, which may be so adjusted as to increase or diminish the speed of the part which does the work. Gear wheels are of various forms, depending upon the velocity desired and the nature of communicating motion. A *beveled gear wheel* has teeth set radially in the face of a cone, while a *spur gear wheel* is one in which the teeth are parallel to the axis of the wheel. In a *worm wheel* the teeth are cut spirally, hence have the effect of a screw.

GEARY (gā′rĭ), **John White,** soldier and statesman, born near Mount Pleasant, Pa., Dec. 30, 1819; died in Harrisburg, Feb. 8, 1873. After studying civil engineering and law, he enlisted in the Mexican War, attained the rank of lieutenant colonel for valuable service rendered in the field, and was made the first commander of the City of Mexico and colonel of his regiment. He was appointed first postmaster of San Francisco in 1849, became mayor of that city in 1850, and was made territorial Governor of Kansas in 1856. When the Civil War commenced, he raised the twenty-eighth Pennsylvania volunteers, commanding in the battles of Chancellorsville, Gettysburg, and Lookout Mountain, and accompanied Sherman on the march to the sea. By reason of distinguished service he succeeded to the rank of major general. He was elected Governor of Pennsylvania as a Republican in 1866, which position he held until within two weeks of his death.

GEBER (gā′bĕr), **Abu-Musa,** chemist, born in Thus, Persia. He is sometimes spoken of as the father of chemistry. Cardan considered him the greatest genius of the Middle Ages. His works, only fragments of which remain, treat of the nature, fusion, purification, and malleability of metals. They make it certain that he understood the processes of distillation of liquids and the construction of various kinds of furnaces. A large number of works attributed to him are extant, some of which are in the libraries of Berlin, Paris, and Leyden.

GEBHARDT (gĕp′härt), **Eduard von,** historical painter, born at Saint Johannes, Russia, in 1838. He studied at the Academy of Saint Petersburg and at the School of Art in Karlsruhe, Germany, and settled permanently at Düsseldorf. In 1873 he was made professor at the Academy of Düsseldorf, where he began

a long line of successful work as an historical painter. In 1886 he was awarded the great gold medal at the Berlin Exhibition. His works consist principally of historical paintings, but he produced many excellent portraits. Among his productions are "Christ on the Cross," Jacob and the Angel," "Reformer at Work," "Entry of Christ into Jerusalem," "Ascension of Christ," "Sermon on the Mount," "Healing of the Palsied," and "Scenes from the Life of Christ." He died Feb. 3, 1925.

GECKO (gĕk'ō), the common name of an extensive family of lizards. They are small animals, seldom exceeding eight inches in length, and the body is covered with numerous round warts. The head is flattened, the body is short and thick, and the eyes are large. The species vary greatly in color, which is usually quite dull. Formerly it was thought that their bite is poisonous, but such is not the case. On the other hand, they are entirely harmless, and are useful in feeding upon insects and worms. They are found quite frequently in cellars and under wet boards and logs. Species closely related are common to all the continents.

GEDDES (gĕd'dĕs), **Patrick,** educator, born in Perth, Scotland, Oct. 2, 1854. He studied at University College, London, and afterward took courses at the Sorbonne, Paris, and the University of Edinburgh. Subsequently he became teacher of natural history in Aberdeen, and afterward was lecturer on the same branch in the School of Medicine in Edinburgh. He was a student of Celtic literature and was progressive as an educator. "Chapters in Modern Botany" and "The Evolution of Sex" are his two chief publications.

GEHENNA (gē-hĕn'nȧ), in Hebrew, the valley of Hinnom, a gorge with precipitous and rocky sides, situated a short distance southwest of Jerusalem. The Jewish kings made it a favorite place for the celebration of religious ceremonies and idolatrous rites. When the pure religion of the fathers was restored in the reign of King Josiah, he defiled the valley in making it a charnel district by covering it with the sewage of the city. It was common to burn the offal and carcasses of animals in order to make the place one of disagreeable repute and thereby destroy it as a resort for idol worship.

GEIBEL (gī'bẹl), **Emmanuel,** poet, born at Lübeck, Germany, Oct. 17, 1815; died April 6, 1884. He graduated at Bonn in 1836, was a tutor at Athens several years, and traveled for some time with Ernst Curtius in Southern Europe. In 1843 he received a pension from the King of Prussia and later was professor of aesthetics at Munich. He took up his residence at Lübeck in 1868 and resided there the remainder of his life. His writings include a number of lyric poems. With Ernst Curtius he published "Classical Studies," and joined Paul Heyse in writing "Romances of the Spaniards and Portuguese." Among his independent works are "Brunhilde," "Autumn Leaves," "New Poems," and "Poems and Reminiscences."

GEIJER (yī'ȧr), **Eric Gustaf,** poet and historian, born in Wermland, Sweden, Jan. 12, 1783; died April 23, 1847. He studied at the University of Upsala and in Stockholm, and later secured a professorship of history in the former. Besides efficiently instructing the university classes, he was a prolific writer of political essays and poems, lectured extensively, and completed numerous musical compositions. In his historical researches he was supported liberally by persons of influence, and exhibited much resource and method in collecting information, though his writings are confined largely to Scandinavian countries. Among his most celebrated works are "Swedish National History," "Gustaf III.," and "Collected Works." The last named constitutes a general collection and was published since his death by his son, together with biographical sketches.

GEIKIE (gē'kĭ), **Sir Archibald,** geologist, born in Edinburgh, Scotland, Dec. 28, 1835. He graduated at the University of Edinburgh and soon after became director of the survey in Scotland. In 1871 he was made professor of geology and mineralogy in the University of Edinburgh, in which position he was succeeded by his brother, James Geikie, in 1882. Later he held a similar position in the Museum of Practical Geology in London. He was one of the founders of the Royal Scottish Geographical Society and was honored by membership and official position in numerous British and foreign scientific societies. He lectured extensively in Canada and the United States, and in 1897 delivered a series of lectures at the Johns Hopkins University. His writings include "Field Geology," "Ancient Volcanoes of Britain," "Landscape in History," "The Founders of Geology," and "Life of Sir Roderick I. Murchison." He died Nov. 11, 1924.

GEISSLER (gīs'lẽr), **Heinrich,** physicist, born in Igelshieb, Germany, in 1814; died Jan. 24, 1879. He learned the art of a glass blower, traveled several years, and finally settled at Bonn, where he established a factory for making chemical and other scientific apparatus. He is best known as the inventor of the sealed glass tubes known as Geissler's Tubes, by means of which are exhibited the phenomena accompanying discharges of electricity through highly rarified vapors and gases. These tubes consist of glass tubes and bulbs, each tube having a platinum wire, which serves as an electrode, and brilliant effects are produced when they are connected with an electric machine. Among other apparatus contrived by him are his normal thermometer, aërometer, and mercury air pump. The last mentioned is an apparatus used to produce an extremely high vacuum.

GELÉE (zhẹ-lā'), **Claude.** See **Claude Lorraine.**

GELSENKIRCHEN (gĕl'zẹn-kĕrk-ẹn), a

city of Germany, in the province of Westphalia, five miles north of Essen, with which it is connected by electric and steam railroads. It is surrounded by a productive coal-mining region and is noted chiefly as an industrial center. The noteworthy buildings include the townhall, the public library, and a number of fine schools and churches. Among the principal industries are machine shops, iron works, flour mills, and soap factories. The rapid growth of the city dates from 1855, when coal was discovered in the vicinity, and it was incorporated in 1875. Population, 1905, 147,005; in 1920, 169,530.

GEM, a precious stone, especially one intended for an ornament. Gems are sometimes found with a natural polish and crystallized in regular shapes, but more commonly with a rough surface and of irregular form. The term is applied particularly to a stone cut and finished ready for setting and wearing as an ornament, as the ruby, sapphire, diamond, and emerald. Other stones are used for ornament to which the term does not properly apply, such as carnelian and agate. The manufacture of artificial gems has made notable progress in recent times. A kind of glass known as *paste* or *strass,* which contains about fifty per cent. of oxide of lead and is peculiar for its brilliancy and hardness, is a common base for artificial gems. Recently some progress has been made in producing gems artificially. These consist largely of rubies, sapphires, and others of the corundum class. Genuine diamonds have been made by a chemical process, but the expense and labor is too great to make the production profitable. Another product of value is obtained by fusing small chips or imperfect stones in an electric furnace. When the fused product is cut and polished, gems of good size and color are obtained.

GEMINI (jĕm′ĭ-nī), the twins, a constellation of the zodiac, containing the two stars Castor and Pollux. The former star is a double one. The constellation may be seen in the Northern Hemisphere during the evenings of December and January. Gemini is a sign of the zodiac, which is entered by the sun about May 21, and the sun passes from it June 21.

GEMSBOK (gĕmz′bŏk), the name of a large antelope in South Africa, called *kookam* by the natives. It is a stout animal, about four feet high and five feet long, and has straight horns about two feet in length. It has a dark gray color above, white on the under part, and markings of white and black on the head. The gemsbock frequents the mountainous districts and usually congregates in small groups when upon the open plain. It is found in many barren desert tracts, where it appears to subsist a long time without water. Its inability to run with great speed is partly compensated for by its strength, which enables it to withstand the attacks of the lion. The flesh is esteemed highly.

GENDARMES (zhän-därm′), meaning men at arms, the name formerly applied in France to the corps of cavalry that formed a bodyguard to the kings. At present the name refers to a military police composed largely of soldiers taken from the army. About 21,000 men make up the gendarmes at the present time. They include both cavalry and infantry, receive higher pay than other men in the army, and form a national police in the departments and colonies of France. Similar forces are maintained in Russia and Germany, where they serve both as soldiers and national police officers.

GENERALIZATION (jĕn-ĕr-ăl-ĭ-zā′shŭn), in psychology, the act of bringing individuals or particulars under a class, or deducting a general principle from particulars. Some writers use the word *generalize* to mean the forming of logical concepts, while others employ it to signify scientific classification. It may be defined as the power of grasping the common qualities of objects and uniting them into a single notion comprehending them all. From this it will be seen that generalization is the power of combining the individual with the general, of uniting the manifold into one. See **Conception.**

GENESEE (jĕn-ĕ-sē′), a river of western New York, which has its source in Potter County, Pennsylvania, and, after coursing northward into New York, discharges into Lake Ontario, seven miles north of Rochester. The total length is 140 miles. It passes through a fertile valley, has falls at Portage and Rochester, and is navigable for small craft about fifty miles.

GENESIS (jĕn′ĕ-sĭs), meaning creation or origin, the name of the first book of the Bible. It is one of the most ancient of existing books, giving an account of the creation, of the original happy state and the fall of man, of the Deluge, and of the dispersion of mankind, ending with the calling of Abraham and the rise and progress of the Jewish nation. Moses is regarded the author of the book of Genesis, but it is supposed that he derived a large part of his materials from written documents coeval with the events recorded, being infallibly guided by inspiration in the entire work. Some writers think that a few additions were made to Genesis after the death of Moses, probably by Ezra. See **Pentateuch.**

GENET (jĕn′ĕt), a carniverous mammal native to Europe and Africa. Only one species is found in the southern part of Europe, whence it extends into Western Asia. Five species are found exclusively in Africa, ranging from the Mediterranean to the Cape of Good Hope. The common genet has a dark gray color, thickly spotted with black, and is nearly allied to the civet. It has retractile claws and a faint smell of musk, and the pupil of the eye is narrow and vertical. The fur is valuable as an article of commerce. It is easily domesticated and is employed in many places to destroy rats and mice.

GENET (zhę-nā'), or **Genest, Edmond Charles Edouard,** diplomat, born in Versailles, France, Jan. 8, 1765; died July 14, 1834. He was trained for a military career and in 1775 became an interpreter for the government. In 1779 he was made an attaché of the French embassy at Berlin and the following year at Vienna, and in 1781 succeeded his father in the department of foreign affairs. He sided with the Girondists during the French Revolution and for some time represented France as ambassador to Holland. In 1792 he was appointed minister to the United States, where he was cordially received, but later denounced the government because it remained neutral in the contest between England and France. His action in enlisting recruits to promote the conquest of Louisiana caused Washington to demand his recall, which was granted in 1794. However, he decided to remain in the United States and was naturalized and took up his residence in the State of New York. In 1794 he married a daughter of Governor Clinton. He translated from the Swedish and Norse writings a work entitled "History of Eric XIV."

GENEVA (ję-nē'vâ), a city of Ontario County, New York, on Seneca Lake, about fifty miles southeast of Rochester. It is on the Seneca and Cayuga Canal and on the Lehigh Valley, the New York Central, and other railroads. Among its municipal facilities are pavements, street railways, electric lights, waterworks, and a library. Besides having a good system of public schools, it contains Hobart College, the State agricultural experiment station, the William Smith College, and the Smith Observatory. Among the manufactures are steam heating apparatus, clothing, scientific instruments, machinery, engines, and boilers. The surrounding country is agricultural and contains many thousand acres cultivated in nurseries. Geneva was incorporated as a city in 1898. Population, 1905, 12,250; in 1925, 15,908.

GENEVA, a city of Switzerland, capital of the canton of the same name. It is situated on the western shore of Lake Geneva, at the point where the Rhone issues, and is connected with European cities by extensive railroad systems.

The city is located on both sides of the lake, though the larger portion is on the south bank of the Rhone, over which several bridges are maintained and facilitate free public intercourse. The two portions of the city are known as the upper and lower, the former containing excellent edifices and beautiful hotels. On the other hand, the lower city is the seat of the commercial institutions and manufactories and the residences of the poorer classes. Among the manufactures are gold, silver, and other metal wares, silk, cotton and woolen goods, leather, calico, hats, musical instruments, clocks and watches, machinery, and chemicals. Of these jewelry, musical instruments, and watches are the most important.

Communication is facilitated by steam navigation on Lake Geneva, the Rhone, and numerous canals, besides by many electric railway lines that center in the city. As a seat of science and literature Geneva takes high rank, its institutions of learning, libraries, museums, and galleries of art ranking with the most famous of Europe. Among the eminent men who resided at Geneva and influenced its learning are Calvin, Knox, Necker, Rousseau, Beza, Sismondi, and Huber. Its cathedrals, public parks, electric lighting system, and statuary take high rank. The university was founded in the 12th century. It carries advanced courses of study and is attended by 1,150 students.

Though originally a Gallic city, it was afterward included in the Roman Provincia, and later passed to the Burgundians and Franks. In the 12th century it witnessed the controversies between the bishops, who were feudatory to the German Empire, and the counts of Savoy, each striving for supremacy. During these contentions the citizens secured numerous advantages, among them religious and political liberties and commercial independence. An alliance was concluded with Freiburg in 1518 and subsequently with Berne, thus making Geneva an important member of the Swiss Confederation. In the Reformation it was a seat and stronghold of Protestantism, becoming so largely under the preaching of William Farel and Calvin. Besides impressing the people with rigid morality, these teachers awakened a taste for the exact sciences. The aristocratic party continued to oppress the people for centuries, although in the 18th century the popular party gained much strength, but the contests that followed might have ended even more dangerously to the people if France and the adjacent cantons had not interfered. France annexed the canton of Geneva in 1798 as the department Du Leman, but in 1815 it became the 22d canton of Switzerland. It is now the seat of the League of Nations. Population, 1920, 171,254; the city, 56,624.

GENEVA ARBITRATION. See **Alabama Claims.**

GENEVA CONVENTION. See **Red Cross Society.**

GENEVA LAKE, or **Lake Leman,** a beautiful fresh-water lake between France and Switzerland, though the larger part of it belongs to the latter country. It is formed as a crescent, has a length of 48 miles from east to west, and is 1,215 feet above sea level. The area is 225 square miles; the greatest breadth, nine miles; and the maximum depth, 980 feet. It is rich in fish, especially trout, pike, salmon, and German carp. The lake is valuable in navigation, being never entirely frozen over in winter. It is entered from the upper end by the Rhone, which pours its turbid and silt-laden water into it, but passes from it clear and transparent. Near the lake are the mountains of Savoy,

while Mont Blanc is visible, though sixty miles distant. The city of Geneva is situated at the point where the Rhone River flows from the lake. Many adjacent localities are celebrated in literature, among them the places treated by Rousseau and Schiller. Byron in "Childe Harold" and "The Prisoner of Chillon" has added interest to the lake.

GENGHIS KHAN (jĕn'gĭs kän), originally known as Temujin, famous Mongol conqueror, born in Deylun Yeldak, near the north bend of the Hoang Ho River, Jan. 25, 1155; died Aug. 24, 1227. He descended from a celebrated Mongol chief, and when thirteen years of age was selected to rule over a number of clans, known as the tribe of Neyrun, which occupied the region between the great wall of China and the Amur River. Being ambitious for conquest, he freed his tribe from paying tribute to the khan of East Tartary, organized a large army, and in 1203 conquered the dominion of Toghrul Ungh. Soon after he extended his dominion from the Pacific Ocean to the Black Sea. His military conduct was so successful and his efforts so well directed that he subdued the Turkish Confederacy, Nayman, the Chinese possession Tangut, and the North Chinese Empire. Several detachments of his vast army carried the campaign as far west as the Crimea, where they established his supremacy, and later returned through the valley of the Volga. His possessions were divided among his children after his death, and traces of his power and influence remained a number of centuries. In religion he was a Mohammedan, though he tolerated other forms of worship, punished crime, exacted taxes for the support of his army, and established a system of postal communication throughout his dominion. Eastern chroniclers maintain that he patronized learning, exhibited marked respect for scholars and architects, and that his civil authority was efficient in protecting the life and property of his subjects.

GENII (jē'nē-ī), in Roman legends, the deities corresponding to the Daemon of the Greeks, and serving to protect all created things and beings from their origin. Each individual person was thought to be accompanied by a Genius from the hour of his birth. In this way he was prompted to good and noble deeds, and the Genius, as a guardian angel, comforted him in sorrow and guided him throughout his earthly career. Cakes, wines, and incense were offered to the Genii as sacrifices on birthdays. The Greeks believed the Daemons to be the spirits of the righteous that had lived in the golden age, and that they watched over mankind and carried prayers and gifts to the gods.

GENNESARET (gẹn-nĕs'ā-rĕt). See **Galilee, Sea of.**

GENOA (jĕn'ō-ā), a seaport city of Italy, capital of the province of Genoa, on the northern shore of the Gulf of Genoa, an inlet from the Mediterranean. It occupies a fine site at the foot and on the slope of the Ligurian Alps. Extensive fortifications surround the city and crown the heights near it. The older portions have narrow streets with lofty buildings, while those of the newer part are spacious and regularly platted and beautified by tall edifices and fine palaces. Orchards and groves of pomegranate and orange trees cover the hills adjacent to the city, and above them rise lofty ranges of towering mountain peaks. The harbor is protected by piers and moles, and is studded with innumerable vessels that carry on an important navigation trade in fruits, cereals, minerals, and manufactured articles produced in the city and surrounding region. Among the manufactures are Italian marble, macaroni, paper, ironware, machinery, cheese, flour, jewelry, gloves, textile fabrics, and scientific instruments.

Many of the buildings are famed in history, among them the Cathedral of San Lorenzo, built in the 10th century; the churches of Santo Stefano and Santa Maria di Carignano; the university, with 1,425 students; and the ducal palace (Palazzo Ducale), built in the 13th century. Other noted buildings include the Theater Carlo Felice, the palaces of Balbi, Doria, Serra, and several others, the town hall, the Plazzo Reale, and the central railway station. The city has a well-organized public school system, schools of fine arts, a military school, the Royal Marine School, a theological seminary, and numerous parochial schools and hospitals. In the public parks are numerous statues, among them several fine marble memorials of Columbus. The Saint George bank building is used as a customhouse and was anciently one of the most stable banks of deposit and circulation in Europe. Its celebrated cemetery, known as Campo Santo, is remarkable for its beauty and the large number of eminent men whose graves it contains. The city is beautified by modern lighting, has electric street railway service, important railroad connections, and is noted for its large commercial and passenger traffic.

Genoa was famous as a seaport under the Romans. It was organized as an independent republic and presided over by doges subsequent to the division made by Charlemagne. Saracen incursions in 935 led the Genoese to form an alliance with Pisa, though in 1119 the two cities engaged in wars and continued hostile until 1294, when Pisa was given a crushing defeat. In the meantime Venice had risen as a successful rival, which led to periodic wars from the 12th to the 14th centuries, and, after discordant strife internally, it became subject to Milan and later to France. Napoleon secured permanent possession of Genoa after the Battle of Marengo, in 1800, and formally annexed it in 1805. In 1815 it became a part of the kingdom of Sardinia, and with it was annexed to Italy. Historically, the Genoese are noted for their spirit of liberality and enterprise. They fostered learning,

encouraged industrial arts, established civil reforms, and built internal improvements. The annexation to Italy within recent times has given the city its present prosperity. Population, 1922, 298,617.

GENSERIC (jĕn'sĕr-ĭk), the most powerful king of the Vandals. He obtained possession of the throne of Spain with his brother Gonderic, and, after the death of the latter, became sole ruler. In 428 A. D. he organized an army of 50,000 men, crossed the Strait of Gibraltar the following year for the purpose of assisting Bonifacius, Roman governor of Africa, and was resisted by the incursions of the Moors. Soon after he conceived the idea of claiming the African possessions of the Romans, and accordingly defeated Bonifacius and founded a kingdom in 439, with Carthage as the capital. Later he conquered Sardinia, Sicily, and Corsica, and laid the conquered regions waste with such destruction that *Vandalism* is still synonymous with barbarism. The Vandals built a large fleet with which they controlled the Mediterranean and captured Rome in 455. They destroyed two Roman expeditions sent against them — the first by Majorian, the western emperor, and the second under Leo, the eastern emperor. Genseric died in 477, reputed the greatest of the Vandal kings, and, according to accounts, was regarded as a scourge of God.

GENTIAN (jĕn'shạn), a genus of plants native to all the continents, but found chiefly in the temperate regions. The *common gentian,* or

ALPINE GENTIAN.

yellow gentian, is native to the mountains of Southern Europe and is found in the meadows of the Alps and Pyrenees. It has opposite leaves, a stem from three to four feet high, and whorls of yellow flowers. The root is employed for medicine to increase the appetite and promote digestion. It is used as a stomachic tonic and is given in the form of a solid, a tincture, an infusion, and as fluid extract. The dried root is a spongy texture with a faint odor, and is intensely bitter to the taste. A species known as the *blue fringed gentian* is found in the southern part of Canada and the northern part of the United States, and other species are more or less widely distributed in North America. The root of the *Alpine gentian* of Europe, which has cup-shaped, blue flowers, is considered the best in medicine, but similar medical properties are contained in other species.

GENTILE (jĕn'tīl), the name applied by the Jews to all who were not of their own nationality. The Jews and Gentiles had an aversion for each other, and the latter were generally regarded in the same spirit as the Christians regard the heathens, though the Jews did not extend to the Gentiles the privileges accorded to pagans by the Christian people. The court of the Gentiles about the temple was the outer space, marked off by a wall or balustrade about four feet high, within which strangers were forbidden to enter, though they might come as far as the barrier to present their offerings. Paul refers to this when he says that "the middle wall of partition" between Jews and Gentiles was broken down by the Gospel.

GENUS (jē'nŭs), in scientific research, a classification of plants or animals which embraces one or more species, closely agreeing in certain characteristics by which they are distinguished from all others. The term applies to forms subordinate to order, tribe, and family. A genus may be constituted of a single species, as the giraffe, which possesses certain characteristics belonging to no other species. In others there are several or many species. To illustrate, the *Mus* constitutes a genus containing such animals as the mouse and the rat, which differ in size and are clearly distinct species, but still have a similarity of structure obvious to all. Among plants the *Rosa* includes the various species of the rose.

GEOFFREY OF MONMOUTH (jĕf'frĭ), historian, born at Monmouth, Wales, about 1100; died about 1154. He was educated as a Benedictine monk near Monmonth, where he became a bishop in 1152. Soon after he was elected bishop of Saint Asaph. He is the author of "Chronicon sive Historia Britonum," which is mainly a translation from an old Welsh manuscript which Walter Calenius, an archdeacon of Oxford, discovered in Brittany, into the Latin. Its historical value is considerable, since it covers an extensive period and is interwoven with many fables and legends. It contains the legends of Arthur and his knights, the romantic fairy pageantry of which can be traced through many centuries of English poetry. Originally this work was divided into eight books and to these Geoffrey added the book of Merlin's "Prophecies."

GEOGRAPHICAL DISTRIBUTION (jē-ŏ-grăf'ĭ-kạl dĭs-trĭ-bū'shŭn), the term applied to

the diffusion of animals and plants in the different regions by natural and artificial means. For centuries the view was held that all species of both the vegetable and animal kingdoms were created within the geographical regions to which the different forms originally were common, but, when the idea came to be held that species are allied and that they originated from a common source, the implication gained widespread foothold that the ancestral stock had a definite birthplace, and from this the various kinds were distributed widely to different provinces and regions. In studying the distribution of plant and animal life it is essential to investigate the means for diffusion and the natural barriers that offer effective obstacles against migration. Animals possessing much power of locomotion, such as fishes, birds, and many land animals, may become easily dispersed to the most remote regions of the continents, and in many cases to adjacent grand divisions.

It is of interest to note that with one exception the mammals of North America are allied to those of the West Indies. From this we may infer that the ancestors of the West Indian animals inhabited the American continent, and that, by some means, they secured passage to those islands. It is likewise interesting to note that the marsupials are confined wholly to America and Australia, that the tapirs are found only in South America and the Malay Islands, that there is a greater difference in the flora of the Pacfic coast of North America and Japan than between that of the latter country and the Atlantic coast plain, and that the birds of North America are more closely allied to those of Europe than to the species which are common to South America. Similar notable instances of distribution may be alluded to in relation to various regions of the continents and oceans, each showing a remarkable dispersement in latitude and longitude of the different forms of life, all, of course, being attributable to some natural cause either clearly known or inferred.

The means to facilitate distribution are quite various and their effectiveness depends more or less upon divers circumstances. In the scope of this article it is possible to call attention only to the more important, since the subject is one which may be treated more properly in works especially designed to throw light upon the various phases, such as Wallace's "Geographical Distribution of Animals," Engler's "Distribution of Plants Since the Tertiary Period," and Darwin's "The Origin of Species."

Besides the normal facilities to disperse which are found in the different species, various other means must be taken into account. Seeds of many classes of plants become widely diffused by winds carrying them to regions remote from their native locality, especially those provided with feathery appendages, while animals, insects, and the movements of water by waves, currents, and streams largely transport and disperse them. Oceanic currents likewise carry animals to remote regions, especially in the polar vicinities by ice floes and icebergs. The branches and trunks of trees frequently carry animals and seeds long distances down streams, across straits, and even over extensive bodies of water. Fur-bearing animals often disperse seeds that cling to the fur, and birds of plumage likewise carry them to distant regions. Aquatic birds transport the spawn of amphibian animals and the seeds of plants to remote districts and freshwater bodies of inland waters. In like manner they distribute shellfishes, seeds of marine plants, and various forms of marine life. It is certain that wide distribution has been effected by seeds clinging to the hoofs of animals and to insects driven by strong winds, and often unintentionally by man.

Among the barriers against rapid and wide diffusion are climatic conditions, elevated mountain ranges, and vast expanses of water surface. It is quite certain that a large per cent. of the general distribution, as occurring in recent times, was effected by the sinking of islands and continents, thus detaching a portion of the land masses and with it its proportional share of animal and plant life, such as was likely effected by the detachment caused by the sinking of large areas of the Pacific, thereby forming the great archipelago southeast of Asia and other island groups equally noteworthy. The more recent diffusions, however, were effected by migration, which doubtless occurred in the usual manner by marine life passing over isthmuses, and land forms, including both plants and animals, being carried across straits and narrow channels of water. The most important and widespread distribution of the higher animal and plant life is due to the commercial designs of man. As a source of profit the various domestic animals and highly cultivated cereals, vegetables and other plants have been carried to climates and latitudes agreeable to their production and use.

GEOGRAPHICAL SOCIETIES, the organizations formed to obtain and disseminate geographical knowledge. In 1821 the first important association to promote and extend geographical knowledge was organized in Paris, known as the Society of Geography, which founded the *Bulletin of the Society of Geography* in 1822. The celebrated German society, the Berlin Association of Geography, was founded in 1828, and its proceedings are published annually in *Reports of the Berlin Association of Geography*. The Royal Geographical Society, founded in 1830, is the leading organization of this kind in Great Britain. Among the societies devoted to the study of geography is the American Geographical Society, founded in New York in 1852; the National Geographical Society, organized at Washington, D. C., in 1888; and the Geographical Society of Philadelphia, established in 1891.

GEOGRAPHY (jē-ŏg′rȧ-fy), the science

that treats of the earth. As a study it is pursued under four departments or branches — mathematical, political, physical, and commercial. *Mathematical geography* is that branch of general science which treats of the earth in its relation to the solar system, and forms the true basis for accurate geographical knowledge, since by means of it we are enabled to form clear conceptions of the laws governing terrestrial phenomena. Through its agency we learn of the location of the earth in space; its form, size, and movements; its divisions by lines and circles imagined to be drawn; and the method of representing portions of it on maps.

Political geography embraces the description of the earth in relation to government and societies of mankind. It treats of the manner of life of the people, and of their civilization and government. *Physical geography* is a treatise of the physical condition of the earth, its relation to nature and the natural laws by which it is governed. It treats especially of the atmosphere, the natural divisions of land and water, the aërial currents and movements of oceanic waters, and the distribution of animate and inanimate objects found upon the surface of the earth. These are described not only in a given locality, but the causes of their existence and the natural results are discussed with a view of learning their causes and effects. *Commercial geography* includes an investigation of the products of merchantable commodities, the migrations of plants and animals, the routes of travel and transportation, and the natural laws that govern or facilitate commerce and commercial relations. In the scope of geographical institutions the student is brought in contact with various other branches, such as geology, history, astronomy, and zoölogy, though these are all separate sciences, the relationship serving principally to facilitate general advancement and to broaden culture in basic principles.

In ancient times geographical knowledge was necessarily limited, owing to the insufficient means to navigate the vast expanse of ocean and proceed with any degree of rapidity across the continents. Besides, the absence of powerful offensive weapons of war prevented exploring parties from making material progress against the hostile peoples occupying distant and unexplored regions. The expanse of geographical knowledge is coördinate with that of explorations and discoveries effected by expeditions and vast cruising enterprises. Among the ancient geographers was Eratosthenes, who flourished about 240 B. C. Greater, however, were Strabo, who lived in the reign of Augustus and Tiberius, and Ptolemy, who flourished at Alexandria about 139 A. D. As a people the Phoenicians made the greatest geographical progress in early history. They not only explored the Mediterranean, but passed through the Strait of Gibraltar, cruised along the Atlantic coast of Africa and Europe, and made voyages as far south as the Tropic of Capricorn and north to the British Isles.

Various views were held by early geographical writers in regard to the universe. They regarded the earth a disk with their own country forming the center. The poems of Homer lead to the conclusion that the Greeks in the 9th century B. C. thought the earth to be a circular plane bounded by water and from which the various streams had their source. In the time of Alexander the Great geographical knowledge was extended by his famous expedition to the interior of Asia, and subsequently by cruises on the Indian and Mediterranean waters. Eratosthenes considered the earth a sphere and was the first to use lines to indicate latitude and longitude, and to employ mathematical principles in the construction of maps. Strabo, also mentioned above, wrote extensively regarding geography as understood in his time, and furnished valuable descriptions and drawings of the countries adjacent to the Mediterranean. Ptolemy prepared a geography of a large portion of Eurasia and Africa, including the British Isles, Germany, large ports of Russia, and all the region between the last mentioned country and the Mediterranean. His geography embraced Northern Africa and large regions of Western Asia.

The ancient geographers remained standard authority during the Middle Ages, and new material of note was not added until the extensive voyages of Marco Polo in the 13th century, who published the first accounts of Japan and the East Indies. However, the discovery of America in 1492 by Columbus, the doubling of the Cape of Good Hope in 1497 by Vasca da Gama, and the discovery of Tierra del Fuego in 1520 by Magellan, with contemporary discoveries and explorations, gave geography an enlargement and interest not previously known. Other achievements worthy of note in this connection are the extensive explorations of Vasco da Gama in Eastern Africa and Southern Asia, the expeditions of Frobisher in 1576, of Davis in 1585, of Hudson in 1607, and of Baffin in 1616, all of which led to the enlargement of accurate knowledge. The Dutch navigators Tasman and Van Diemen made fruitful explorations in the Pacific about the middle of the 17th century and added Australia to the explored portion of the earth. Subsequently Captain Cook explored innumerable islands in the Pacific.

The explorations of the 19th century were devoted more largely to discoveries in the polar regions and the interior of Africa. Exploring expeditions were sent to the Antarctic regions from America, England, and France in 1840, when Victoria Land and the Antarctic continent were discovered. Another important discovery was that of the northwest passage around North America by way of Bering Strait and Baffin Bay. It was made in 1850 by an expedition under McClure. Among the most cele-

brated explorers to add knowledge of the interior of North America are Lewis and Clark, Humboldt, Spix, and Frémont, while the interior of Asia and Australia likewise became known largely in the latter part of the last century. The explorations and discoveries of interior Africa by such eminent men as Livingstone, Schweinfurth, Stanley, Bruce, Barth, and Rohlfs have led European nations to occupy practically the entire continent. They not only claimed the regions as colonial possessions, but constructed canals, founded cities, and built vast railroad enterprises. Interior Asia is now in a fair way to become similarly controlled by European peoples. Not satisfied with their successes, the more ambitious are still making venturous exploits to the polar seas, and are promoting extensive excavations to determine complicated questions in physical geography. School textbooks are assuming scientific completeness and institutional instruction is becoming of greater pedagogic worth. The schools of Germany have long led in both these important lines.

GEOLOGICAL SURVEY (jē-ō-lŏg'ĭ-kạl sûr'vā), the name of a bureau maintained by most governments, which has charge of investigations of the mineral resources and geological structure of the country. Bureaus of this kind are under the supervision of a director, who is controlled directly by a cabinet or ministerial officer. In Canada the Geological Survey Department is under the Minister of the Interior and the work is divided into two divisions, known as (*a*) Geological Survey and (*b*) Mines Branch. The direct supervision is under an officer known as assistant director, chemist, and mineralogist, while each of the two divisions is supervised by a director.

The United States Geological Survey was organized as a bureau in 1879, when a plan for unifying the four independent surveys that have been maintained was adopted by Congress. It is under the control of a director, who submits an annual report of plans and operations of the department to the Secretary of the Interior. Among the duties of this department are the making of surveys in regard to the geological formations, the classifications of public lands, the surveys for the irrigation of arid regions, the examination of mineral deposits, the survey and mapping of the areal geology, and detailing information of the rock formations. Maps prepared by the department indicate the character of the surface, the distribution of ores, and the character of the soil. Many pamphlets are published to distribute information in regard to physical and chemical research, mining and mineral resources, and various other subjects of interest coming under consideration of the department.

GEOLOGY (jē-ŏl'ō-jў), the department of natural science that treats of the present constitution and structure of the earth and the operations of its physical forces. It investigates the history of geological formations in past ages, together with the causes and modes of physical changes, and the formation of inorganic and organic structures. The study of geology received attention many centuries ago, but it has taken high rank among the studies only since the beginning of the last century. Herodotus gave the subject much careful thought. He devoted studious consideration to the formation and fertility of the soil in Egypt, and traced their cause to the silt-laden waters of the Nile that overflow the delta and Lower Egypt periodically. Strabo flourished in the 1st century A. D. and ranked as the greatest of early geologists. He took up the discussion of the origin of fossils (q. v.), which long formed the subject of much controversy, and maintained that they were organic when entombed.

Dr. Abraham G. Werner (1750-1817), professor in the school of mines at Freiburg, Germany, in 1775, gave modern geology its widespread interest. He held that a series of universal deposits had been formed by the action of a chaotic fluid, which evaporated and fell on the earth's crust in periodical succession and otherwise operated to erode and deposit silts. He thought this action aided in cooling and thickening the crust, and that it had a marked influence upon the distribution of materials which exuded or were thrown from volcanic craters. In 1788 James Hutton published his "Theory of the Earth," in which he directed attention to the causes that now exist in producing formations. He held a contrary view to Dr. Werner in that he thought granite and basalt are of igneous origin.

At present there are three recognized schools of geology, those known as catastrophism, uniformatarianism, and evolutionism. Those holding to *catastrophism* maintain that there have been a series of creations and catastrophies, life forms springing into existence and after a great lapse of time meeting with universal destruction, as in the deluge of Noah. Of this school Sir Roderick Murchison is a representative. Those holding to the theory of *uniformitarianism* think that causes now in operation alone constitute the reasons of all geologic phenomena. To this theory Sir Charles Lyell holds, and he exemplifies it in his "Principles of Geology." He cites in support of his opinion the action of rivers, tides, currents, and ice as the causes of stratified rock and other formations, directs attention to the action of volcanoes and earthquakes as agencies in producing igneous and metamorphic results, and states his belief that collectively they are sufficiently potent to cause nearly every phenomenon witnessed in studying the earth's crust. Those holding to *evolution* (q. v.) accept all the theories of the uniformitarians, except those referring to the development of life forms. Of this school Darwin and Huxley are representatives, the latter assigning from 1,000,000 to 300,000,000 years as

the time required for the production of the present conditions in geological phenomena.

It is probable that both the surface and interior of the earth were once highly heated, a condition probably still existing within the earth, and after cooling gradually formed a thin layer or crust at the surface. The lowest rocks, being of igneous or heat formation, are called igneous rocks, of which granite is an example. Owing to the presence of intense heat while forming, life could not exist, hence fossils do not abound. At that time the waters which now cover a large portion of the earth hung over the surface as dense vapor, but, as soon as a thin crust had formed, the cooling atmosphere tended to bring the vapor to the dew point and it fell to the surface in the form of rain. By continued cooling the crust became thicker, while contractions wrinkled the surface and caused portions to form dry land by emerging from the ocean. By the action of the water and that of heat and cold vast quantities of materials were broken up and ground into sand, clay, gravel, and other forms, which were carried to particular locations and stratified into strata of slate, sandstone, shale rock, and other common forms. These rock formations are known as aqueous or sedimentary, and contain more or less fossil remains. The heated interior long remained the seat of volcanic disturbances, which formed channels through the crust, and still give evidence of internal action and general contraction by occasional, though diminished, eruptions. The rocks modified by the action of heat are known as metamorphic.

Geologists make subdivisions of time based on the main rock systems, in each of which peculiar characteristics and organic remains, if present, have been studied and classified. These are shown in an ascending order in the following table:

LIFE PERIODS.	ROCK SYSTEMS.
Post-Tertiary or Quaternary	Recent—Alluvial, Peat, etc. Pleistocene.
Tertiary or Cenozoic	Pliocene. Miocene. Oligocene. Eocene.
Secondary or Mesozoic	Cretaceous. Jurassic (Oölitic. Liassic.) Triassic.
Primary or Palaeozoic	Permian or Dyas. Carboniferous. Devonian and Old Red Sandstone. Silurian. Cambrian.
Archaean, Laurentian, or Eozoic	Fundamental Gneiss.

The five principal periods or times are divided into ages in which the forms of life are classified in an ascending scale as follows:

Quaternary	The Age of Man.
Cenozoic	The Age of Mammals.
Mesozoic	The Age of Reptiles.
Palaeozoic	The Age of Coal Plants. The Age of Fishes. The Age of Invertebrates.
Archaean	The Lifeless Age and Dawn of Life.

The Archaean time witnessed the dawn of life. It included an extensive era, and the temperature was so extremely high that life could not have existed. However, the simpler forms began to be created toward its close. The rocks of this period resulted from cooling of the molten mass of the earth and became the covering of the entire surface, including the regions below the ocean. On the older archaean rocks sedimentary rocks less ancient were deposited. At this period North America was largely submerged. Only portions in the vicinity of Lake Superior, the Iron Mountains of Missouri, the Blue Ridge range, the Wind River Mountains, the ranges farthest east in Colorado, and the New Jersey Highlands projected above the highly heated water. These portions constitute the oldest part of North America. It was within this time that iron was formed, the rocks of this period containing a large per cent. of iron ore. The Laurentian and Huronian are among the North American rocks that then existed, the former in the vicinity of the Saint Lawrence and the latter near Lake Huron, from which they were named.

In the Palaeozoic time the animals and plants but slightly resembled those now living. Fossil remains are mostly those of mollusks, protozoa, radiates, and articulates. The rocks were made under water and consist of vast deposits of limestone, sandstone, and shales, which are either largely or entirely formed of the remains of shellfish, clams, oysters, and other similar forms of life. This is known as the Silurian or Age of Invertebrates. The Devonian Age followed, in which the first vertebrates appeared in the form of fishes. Plants became abundant and vast swarms of insects appeared. In the Carboniferous Age the surface was covered with many fernlike and other plants which were of gigantic size and ultimately formed beds of coal (q. v.) by the remains decaying under water. The period was characterized by alternated elevations and subsidences, thus forming in some regions two or more coal veins by being tilted, as in many regions of the Allegheny Mountains. In this period all the animals of the subkingdoms lived and reptiles began to appear.

In the Mesozoic time, known also as the Age of Reptiles, the plants and animals began to resemble existing species. The reptiles were greatly in preponderance and included many species of snakes, turtles, and crocodiles. The ichthyosaurus, an animal that swam in the sea or paddled in the mud, and the plesiosaurus, a large reptile with a snakelike neck, were common in this period. Great birds, such as the archaeopteryx (q. v.), lived at this time and left their foot imprints as fossil remains by walking over the forming rocks.

In the Cenozoic time North America was largely above the sea, though numerous large lakes with fresh water were abundant, the

largest of which extended from Texas northeasterly to Nebraska. This period bears evidence that vegetation was still abundant in the Arctic zone, where fine forests of redwood, magnolia, and other species native to warm climates extended over vast regions. Large animals, including elephants, were abundant in the Rocky Mountains, of which fossil remains are not uncommon. The glacial period swept over the northeastern portion of the continent of North America at that time with its destructive effects upon life forms, causing vast drifts and carrying great boulders, reaching south to about the 40th parallel. The glacial period was followed by the Champlain period, in which alternating floods and varying climates followed in succession. Subsequently the climate was again tropical, when many animals inhabited the forests, while slowly through long periods of time the temperature gradually fell. In the Quaternary Age the present animals and plants appeared and man was created. Geologists differ as to the length of the creation period measured in years, and many do not undertake to assign any given number of years. They commonly call all time before life appeared Azoic and the appearance of life Eozoic, and classify all subsequent time as exemplified above.

GEOMETRY (jē-ŏm'ĕ-trў), the science that relates to the measurement of definite portions of space, such as lines, angles, surfaces, and volumes. The various divisions of geometry include plane and solid geometry, analytical geometry, descriptive geometry, and higher geometry. *Plane geometry* and *solid geometry* treat of right lines and plane surfaces, and of circles and spheres. In *higher geometry* are treated the conic sections, curved lines, and bodies generated from them. In *analytical geometry* are involved the various calculi in algebraical forms, while *descriptive geometry* embraces an extension of the principle of projections.

The origin of geometry is traced to the Hindus, but the Egyptians appear to have possessed a knowledge of it at the times the pyramids were built. Thales, who flourished in 639-548 B. C., is among the first of the Grecian geometrists, and to him is attributed the discovery of the properties of triangles. Pythagoras was a disciple of Thales. He greatly extended the knowledge of the geometry of polygons by discovering the theorem of the square of the hypotenuse. He demonstrated that the area of a circle is greater than that of any plane figure having an equal perimeter, and that the sphere has the greatest volume of the bodies which are bounded by an equal surface. Many other Greeks followed in adding to the science, among them Anaxagoras, Hippocrates, Plato, and Euclid. The last mentioned founded a school of mathematics in Alexandria, Egypt, some time in the reign of Ptolemy I., in 323-284 B. C. He published a treatise on "Porisms," a book on "Data," and his "Elements of Geometry." Most of his works are lost, but his "Elements" are still in use in many schools and colleges. Among the celebrated geometricians of recent times are Kepler, Descartes, Pascal, Newton, and Carnot.

GEORGE I., Christian William, King of Greece, second son of Christian IX., King of Denmark, born in Copenhagen, Dec. 24, 1845. He was liberally educated and subsequently served with distinction in the Danish army. After the abdication of Otho I., King of Greece, in 1863, he was elected king by the Greek national assembly, and accepted the crown with the consent of the treaty powers. In 1867 he married Princess Olga, daughter of Grand Duke Constantine, at Saint Petersburg. His administration has been popular, though his reign was disturbed by diplomatic and military difficulties in the Balkan peninsula. In the war with Turkey, in 1897, he took an active interest for the betterment of conditions in Crete, but lost some territorial advantages. He was slain by an insane man Mar. 18, 1913, and was succeeded by his son Constantine I., Duke of Sparta. The latter was born Aug. 2, 1868, and distinguished himself in two Turkish wars, but was deposed by England, France and Russia in 1917, because of his neutrality in the war. He died Jan. 11, 1923.

GEORGE I. OF GREECE.

GEORGE I., son of Ernest Augustus, King of Great Britain and elector of Hanover, born in Hanover, Germany, May 28, 1660; died June 10, 1727. In 1682 he married Josephine Dorothea of Zell, succeeded his father as elector of Hanover in 1698, and commanded the imperial army in 1717 during the War of the Spanish Succession. His claim to the throne of England was based upon the rights of his mother, who was declared the heiress to the crown by the Act of Settlement in 1701. Immediately after the death of Queen Anne, in 1714, he ascended the throne with the active support of Marlborough and the Whigs. His reign was marked by force of character, but Sir Robert Walpole was the chief influence in the government. The notable events include several risings of the Stuarts, the triple and quadruple alliances against Spain, and the organization and failure of the South Sea Company in 1720. He was the first representative of the Hanover dynasty in England.

GEORGE II., son of George I., King of Great Britain, born Oct. 30, 1683; died Oct. 25, 1760. In 1705 he married Wilhelmina Caroline of Brandenburg-Anspach, who was a woman of

good character and a strong personality, and in 1727 he succeeded his father. His interest in the government was more strongly exemplified than that manifested in his father's reign, though his policy was largely shaped by Walpole and Pitt. In this period Canada was conquered for England, the British Empire extended its influence in India, and the colonial policy of Great Britain was greatly augmented.

GEORGE III., King of Great Britain, eldest son of Frederick, Prince of Wales, born in London, June 4, 1738; died at Windsor Castle, Jan. 29, 1820. He succeeded his grandfather, George II., married Princess Charlotte Sophia of Mecklenburg-Strelitz. The mind of George III. failed in 1810, after which he became insane.

GEORGE IV., King of England, son of George III., born Aug. 12, 1762; died Jan. 26, 1830. In 1811 he became regent because of his father's insanity and in 1820 succeeded to the throne. Among the events of his reign is the Catholic Emancipation Act passed in 1829 by the Wellington ministry. As he died without descendants, his only daughter having died childless in 1817, he was succeeded by his brother, Duke of Clarence, with the title of William IV.

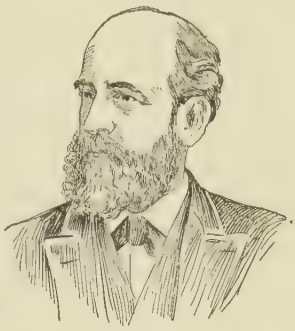
GEORGE V., son of Edward VII., King of England, born June 3, 1865. He became heir-apparent on the death of his elder brother, in 1892, and made a tour of the world in 1901.

GEORGE V.
George Frederick Ernest Albert.

In 1893 he married Princess Mary of Teck, and in 1910 succeeded his father. The Great European War presented the leading issues of his reign. He is noted for his personal worth and popularity.

GEORGE, Fort, a small fortress of Canada, near Queenstown, Ontario, on the Niagara River. General Brock took up his headquarters at Fort George in 1812, where he was defeated on May 27, 1813, by a force of Americans.

GEORGE, Henry, political economist, born in Philadelphia, Pa., Sept. 2, 1839; died Oct. 29, 1897. He was apprenticed when a boy to learn the art of a seaman, but after reaching California he engaged in journalism, and became one of the founders of the *Post* of San Francisco. In 1876 he was appointed State inspector of gas meters, three years later was made trustee of the San Francisco free library, and about the same time published "Progress and Poverty," a work on economics that won wide popularity. In 1880 he settled in New York, visiting Europe the following year to study the land question, and made several subsequent visits to the British Isles and continental Europe. He promulgated his theories by lecturing extensively and by organizing single-tax clubs in many sections of the country. Among his best known publications are "The Land Question," "Social Problems," "Protection or Free Trade," and "The Irish Land Question."



HENRY GEORGE.

GEORGE, David Lloyd, statesman, born in Manchester, England, in 1863. His father, William George, a Welsh schoolmaster, died in 1865, and the son was reared in Wales by an uncle. He studied law, was elected to parliament in 1890, and entered the cabinet of Campbell-Bannerman in 1906. On the death of Kitchner, in 1916, he became head of the war council, and before the end of the year succeeded Asquith as premier. His public life witnessed the advance of many important reforms.

GEORGE, Lake, a beautiful lake in northeastern New York, extending from southwest to northeast. The length is thirty-five miles, breadth, from one to three miles; and greatest depth, 400 feet. The surface has an elevation of 310 feet above sea level. On its northern shore are the ruins of Fort Ticonderoga. The shores are beautified by lofty hills, on which picturesque forests abound. The outlet is into Lake Champlain, which is a short distance toward the north. Lake George is a popular resort for many artists and tourists.

GEORGE, Saint, the patron saint of England, who is venerated by both the Greek and Roman churches. His history is legendary, but it is thought that he was born at Cappadocia of noble Christian parents. He secured distinction as a soldier, professed his faith before Emperor Diocletian, and on April 23, 303, suffered martyrdom at Nicomedia. He was first honored as a Christian martyr in Phoenicia, but later also in Palestine and the whole of Western Asia. Many churches were built to his honor, the Hellespont was named Saint George's Arm, and his fame spread rapidly to the west. In France

he was honored by the military profession in the 6th century, but the most widespread information of him came about after the Crusades, by which knowledge of various incidents connected with his life spread to all parts of Europe. In 1350 he was made the patron of the Order of the Garter by Edward III., and in the 15th century Frederick of Austria established an order of knighthood in his name. Several countries adopted banners to designate allegiance to the members of Saint George. They consisted of white with a red cross, and in some countries minute badges were worn on the arm of soldiers. Russia regards him as the patron saint of the imperial domain.

GEORGE FREDERICH ERNEST ALBERT. See **Prince of Wales.**

GEORGE JUNIOR REPUBLIC, the name of a community maintained for boys and girls near Freeville, N. Y., about eight miles west of Ithaca. It was established by William R. George in 1895. The purpose is to afford employment and training for unfortunate children, most of whom are obtained from the cities. This community has a constitution modeled after that of the United States, which provides for the election of legislative, judicial, and executive departments. Mr. George was the first president, but this and all other offices have been filled by boys since 1896, though the power to veto is retained by Mr. George. It is incumbent upon the members of the community to work at some occupation, such as carpentry, printing, blacksmithing, farming, or domestic science. The buildings include a store, a library, a bank, and a school, and several hotels, restaurants, and workshops. Primary and grammar schools are provided for all children under sixteen years of age and the courses fit the students for academic or college work. The trustees of the enterprise control about 400 acres. At present the average attendance is about 225 children.

GEORGETOWN (jôrj'town), the capital of British Guiana, situated near the mouth of the Demerara River, in Demerara County. It is the most important city of the Guianas. The streets are regularly platted, with fine shade trees and buildings, and the city is connected with adjoining trade centers by railways. Among the public buildings are the town hall, the Parliament building, the Episcopal cathedral, Queen's College, a mariners' hospital, a public library, and a museum. Besides its public school system, there are a number of flourishing historical and scientific societies, and divers religious and economic associations. The streets articulate with several canals which furnish convenient connection with the harbor. Most of the buildings are placed on piers to elevate them above the low site. The principal exports include coffee, sugar, fruits, and rum. Among the imports are machinery, fabrics, and manufactured articles. The city is the center of the export and import trade of the colony, has a good harbor, and is well fortified. Three-fourths of the inhabitants are Negroes and people of native birth. Population, 1922, 54,692.

GEORGETOWN, a city of South Carolina, county seat of Georgetown County, 55 miles northeast of Charleston, on the Seaboard Air Line Railroad. It is located at the head of Winyah Bay and is important as a seaport. The trade consists chiefly in rice, fish, turpentine, cotton, and machinery. It has electric lights, waterworks, and a number of fine school and county buildings. The first settlement was made on its site about 1700 and its incorporation dates from 1805. Population, 1920, 4,579.

GEORGETOWN UNIVERSITY, an educational institution in Georgetown, D. C., which is now included within the limits of Washington. The university was founded in 1789 and later, in 1815, it was empowered by Congress to grant academic degrees. It is under the auspices of the Society of Jesus, an order of the Roman Catholic church, and carries courses in dentistry, medicine, law, philosophy, and theology. Degrees are conferred in arts, dentistry, law, medicine, and philosophy. About 2,500 students attend the different departments. The library contains 180,000 volumes.

GEORGE WASHINGTON UNIVERSITY, an institution of higher learning located at Washington, D. C., the origin of which dates back about ninety years. It was originally the Columbian College of the District of Columbia and was chartered by a special act of Congress on Feb. 9, 1821, with all the powers commonly granted to American colleges. By a special act of March 3, 1873, Congress changed the name to the Columbian University. By another special act of Congress on Jan. 23, 1904, the Columbian University was authorized, on compliance with certain formalities, to take a new name, the name chosen to be approved by the Secretary of the Interior and the Commissioner of Education. These formalities were complied with, and on Sept. 1, 1904, the present name was adopted. On March 3, 1905, Congress recognized the George Washington University by this name and conferred upon it additional powers of the most comprehensive nature for carrying on higher education. It may, under its charter, apply in whole or in part the English system of carrying on undergraduate work through colleges which are educationally under its jurisdiction. Such colleges are organized by permission of the university under a special incorporating act contained in the university charter. Each college has its own trustees, faculty, and financial foundation, separate and distinct from the university. All are, however, so under the jurisdiction of the university that they must conform to the standards set by it and can only present to it their candidate for degrees, all degrees being conferred by the university. It carries on graduate work directly through its special university lectures. All the

existing university systems may thus be applied by it in carrying on its work; and by this composite plan of organization, combining the advantages of a federal and a unitary system, the work of the university is standardized and coördinated, the time of the student is economized, and the institution is kept at the highest point of efficiency.

In addition to its power to permit the incorporation of colleges in the District of Columbia which are educationally under its jurisdiction, the university is authorized to affiliate with itself institutions of learning outside the District, which may desire to have the benefit of university affiliation at Washington. This feature enables colleges to enter into arrangements whereby their students may do some of their work in the national capital and receive credit for it towards the degree given by the college, while these students may, at the same time, be pursuing graduate or professional studies and taking their graduate or professional degree at the university.

A provision of the charter reads as follows: "Persons of every religious denomination shall be capable of being elected trustees; nor shall any person, either as president, professor, tutor, or pupil, be refused admittance into the university or be denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion." The board of trustees is organized so that no religious denomination has a control. The charter provides for a board of visitors, which may be representative of the interests of the country at large, and which will assure the observance of every provision of the charter.

The university has, in its various faculties, over three hundred professors and teachers. It has 6,500 students, every State in the Union being represented, as well as foreign countries. It gives full day instruction in all its colleges and departments. Undergraduate work in arts and sciences is done by Columbian College, which is a corporation recently organized under the provisions of the charter, a College of Engineering, and a College of Pharmacy. The possibility of giving undergraduate instruction through colleges under the jurisdiction of the university, on the broadest as well as on the most specific and practical lines, is thus illustrated. The graduate work of the university is done through a graduate department of the arts and sciences. It has a department of medicine, a department of law, a college of the political sciences, and a teachers' college.

The college of the political sciences carries on undergraduate, graduate, and professional instruction in American history, politics, economics, finance, international law, and diplomacy. It has distinguished teachers and lecturers and has graduated many young men who now hold important positions in the civil and foreign service of the United States.

GEORGIA (jôr'jĭ-ȧ), a State of the United States, one of the original thirteen, popularly called the Empire State of the South. It is bounded on the north by Tennessee and North Carolina, east by South Carolina and the Atlantic, south by Florida, and west by Alabama. Its length from north to south is 330 miles; width, 253 miles; and area, 59,475 square miles, including 495 square miles of water surface.

DESCRIPTION. The State lies partly in the coastal plan and partly in the Appalachian highlands. In the eastern part are the Blue Ridge Mountains, which cross into the State from North Carolina and terminate in the northern part of Georgia. These mountains have a general elevation of from 3,000 to 5,000 feet, culminating in Sitting Bull Mountain, which has an elevation of 5,046 feet above sea level. In the western part is the Cohutta group, which is a continuation of the Unaka Mountains of Tennessee, and the Lookout and Sand Mountain ranges are in the northwestern corner. A broad plain characterizes the coastal region, where the surface is slightly elevated above the sea, but it rises quite uniformly toward the interior. Between the coastal plain and the mountains is a broad area known as the Piedmont plateau, which extends over about one-third of the State. Numerous swamps prevail in the low region of the coast, but the largest marshy tract is the Okefinokee Swamp, which is 30 miles wide and 45 miles long, and a small part of it extends into Florida. Off the coast are numerous islands, including Ossahaw, Saint Catherine's, Sapelo, Saint Simon's, and Cumberland.

GEORGIA.

1, Atlanta; 2, Augusta; 3, Columbus; 4, Macon; 5, Savannah; 6, Brunswick. Chief railways are shown by dotted lines.

The rivers form a valuable network of drainage and furnish considerable transportation facilities. Much of the northeastern boundary is formed by the Savannah River, which is

navigable to Augusta. A large part of central Georgia is drained by the Altamaha, which receives the inflow from the Oconee and Ocmulgee, and is navigable to Macon. Other rivers that flow into the Atlantic include the Ogeechee, the Satilla, and the Saint Mary's, the last mentioned forming a part of the northern boundary of Florida. The Coosa and several of its tributaries, which belong to the Alabama River basin, drain the northwestern part of the State. A number of rivers flow southward into the Gulf of Mexico, including the Appalachicola, which is formed at the southwestern corner of the State by the junction of the Flint and the Chattahoochee, the latter forming a large part of the western boundary. No lakes of importance are located within the State, but a number of lagoons and sounds characterize the coast.

The State has a wide range of climate. On the coast in the southern part the annual average temperature is 70°, while in the valleys of the mountain regions it falls somewhat below 40°. In the northern part the climate is quite equable, no season of the year being severe or marked with extremes. Snow and frosts are very rare in the southern part, where the summers are long and the climate is similar to that of Florida. Brunswick has a mean temperature of 69°; Athens, 63°; and Atlanta, 61°. The State has an average rainfall of 48 inches, being greatest in the northern and smallest in the southern part. Fevers and malaria are not infrequent in the marshy region, but all other parts are healthful the entire year. Far toward the interior extend beautiful forests of palmetto, oak, beech, magnolia, elm, and other useful species of timber. The wild animals include alligators, wildcats, bear, opossum, and many species of birds and waterfowl.

Mining. Many minerals are found in the mountainous region of the northwestern part. Both coal and iron are obtained in considerable quantities, hence supply a considerable share of the material used in manufacturing. Gold has ben produced in paying quantities for about a century, and the State yields nearly one-half of the manganese produced in the United States. Georgia marble is a peculiarly valuable product, both for monuments and the construction of bridges and buildings. It is especially valuable for finishing stone. Other materials include silver, bauxite, limestone, granite, amethyst, and beryl.

Manufacturing. Within recent years the manufacturing interests have been greatly enlarged and diversified, and the State takes a high rank in this respect among the southern states. The forests yield vast quantities of turpentine and tar, and a large part of the lumber products is utilized in making furniture and machinery. However, in the value of the output, the first place is held by textiles. In the manufacture of cotton products Georgia is surpassed by only three of the New England states. These products include textiles, hosiery and knit goods, cottolene, and cotton-seed oil and cake. The manufacture of fertilizers has made rapid progress, which is true likewise of railway cars, machinery, flour, clothing, and rosin.

Agriculture. About seven-tenths of the surface is in farms, hence agriculture is the leading industry. A larger acreage of land is improved at present than at any former period, and the farms average a smaller size. This is accounted for by the fact that many of the large plantations have been subdivided and are worked by Negro farmers, though fully 65 per cent. of the land is worked by the whites. Cotton and corn are the chief crops, and the value of the product of these is about equal, though formerly cotton held a much larger place than corn. Sea-island cotton of a fine quality is grown extensively along the coast and on the islands, and the upland species thrive in all parts of the State. In 1922 the State had 3,943,083 acres in cotton and 4,477,684 acres in corn. Oats and wheat which are grown on about an equal area, have an acreage of less than one-tenth of either corn or cotton. Other farm products include rice, hay, potatoes, peanuts, and sugar cane. Cattle are grown both for meat and dairy purposes, each of which receives marked attention. Other domestic animals are mules, swine, horses, sheep, and poultry. Fruits of all kinds can be grown profitably. The State has very large interests in the culture of oranges, lemons, pineapples, peaches, pears, apples, and garden vegetables.

Transportation. The State has a coast line of 128 miles and a large mileage of navigable streams. In 1926 the railroad lines aggregated 7,195 miles, exclusive of the many interurban lines of electric railways. All of the counties have railway or river transportation facilities, hence every section can be reached conveniently. Atlanta, Savannah, Albany, Macon, Columbus, Rome, Athens, and Waycross are among the principal railway centers. Savannah is the chief export city, being located near the mouth of the Savannah and on a number of railways. Brunswick and Saint Mary's have a considerable foreign commerce. The chief exports include cereals, cotton, turpentine, granite and marble, machinery, manganese, and textiles. The fisheries, especially shad and oysters, furnish considerable material for exportation.

Education. Educationally, Georgia has attained to an enviable position among the states of the South. Common schools are maintained throughout the State and are instrumental in causing illiteracy to decrease rapidly. Funds are supplied liberally to maintain high schools in the larger centers of population, while normal schools and other institutions of higher learning are rapidly multiplying and increasing in effective value. The number of higher insti-

tutions maintained for white pupils include several universities, and about forty colleges and private institutes, while the needs of the Negro youth are met by six higher institutions. The State University of Georgia, which is at the head of the system of education, is situated at Athens. Other institutions which are maintained under State support include the North Georgia Agricultural College at Dahlonega, a normal and industrial school for girls at Milledgeville, a technological school at Atlanta, and an industrial college for Negroes near Savannah. Besides these are numerous denominational and nonsectarian institutions of higher learning, among them Mercer University at Macon, Emory College at Oxford, the Wesleyan Female College at Macon, and the Lucy Cobb Institute at Athens.

GOVERNMENT. Georgia is governed by a constitution which was ratified by the people in 1877. It confers the right of suffrage to all citizens 21 years of age, with the requirement that they shall have been citizens of the State one year and of the county six months, and that they have registered and paid assessed taxes. The Governor is elected for a term of two years and is ineligible for four years after having served two terms. He has the power to veto bills passed by the Legislature, but his veto may be overcome by a two-thirds vote of each house. Representation in the Legislature depends upon a population basis, and bills appropriating money must originate in the house of representatives. The legislative branch consists of two houses, the senate and house of representatives, and the members of each are elected for a term of two years. A chief justice and five associate judges make up the supreme court, in which the terms of service are six years. Each judicial district has a superior court judge, who is appointed for four years by the General Assembly. The justices of the peace, who are elected for four years, have local jurisdiction in the militia districts.

INHABITANTS. The State has eighteenth rank in the number of inhabitants and next to Texas is the most populous southern State. In some counties the Negroes greatly outnumber the whites, especially in the southern part of the State, and the whites are most numerous in the mountainous regions. Atlanta, the capital, is the largest city. Savannah, on the Atlantic coast, is the chief seaport. Other cities of importance include Augusta, Macon, Athens, Rome, Brunswick, Thomasville, and Columbus. In 1900 the State had a population of 2,216,331. This number included 1,035,122 colored persons, or 46.7 per cent. The total negro population was 1,034,199. Population, 1920, 2,894,683.

HISTORY. The history of Georgia begins in 1540, when De Soto visited that region with 600 Spaniards in search of gold. However, not until 1733 were permanent settlements made. At that time James Oglethorpe founded a colony for the refuge of poor debtors and the persecuted Protestants of Germany, and named the colony in honor of George II. The settlement founded developed into the city of Savannah, but in 1752 the charter granted Oglethorpe was surrendered to the British and Georgia became an English province. During the Revolution the people of Georgia entered into the struggle for liberty with much enthusiasm, but many were compelled to leave their homes by the invading armies of England. The first constitution was framed in 1777, and on Jan. 2, 1788, the Constitution of the United States was ratified. In 1838 the Creek and Cherokee Indians were removed to Indian Territory, now Oklahoma, after prolonged troubles and local wars.

In the Civil War Georgia sided with the South, seceding in 1861, and furnishing an effective force for the Southern army. Its own capital, Atlanta, was for a brief time the capital of the Southern Confederacy. Sherman marched through the heart of the State when on his famous expedition to the sea. The recent history is one of large agricultural, manufacturing and mining development. Several industrial exhibitions have attracted attention to the superior resources of the State, such as the National Exposition held at Atlanta in 1881. The State enacted a law in 1907 which forbade the sale of liquor after Jan. 1, 1908.

GEORGIA, formerly a kingdom of Europe, but now a part of the Russian Empire. It comprises the territory lying south of the Caucasian Mountains, between the Caspian and the Black seas, and is bounded on the south by Persia and Asiatic Turkey. The region is divided into the Russian governments of Kutais, Baku, and Tiflis. Anciently it comprised the kingdoms of Albania, Colchis, and Iberia. The Georgians trace their history back to Japhet, but little is known of them until the time of Alexander the Great, who conquered their country, and after his death they established a government of their own. In the 4th century they became Christianized, but many of them are now Mohammedans. Georgia prospered until the 13th century, when it was conquered by the Mongols, and Timur laid it waste in the 14th century, but it was liberated in the 15th century by George VII. He was succeeded by Alexander I., who divided the territory among his three sons. It was invaded a number of times by the Persians and Russians until 1802, when Paul, Emperor of Russia, proclaimed it a part of his royal dominion. The Georgians speak a language that is regarded a link between the tongues of Eastern Asia and those of the Indo-European peoples.

GEORGIA, Strait of, a large inlet from the Pacific Ocean, in the northwestern part of North America, which separates Vancouver Island from the mainland. It is about 250 miles long, in a direction from southeast to northwest, and has an average width of 25 miles.

The Fraser River discharges into it. It is connected with the Pacific Ocean at its northern end by Queen Charlotte Sound and at its southern end by the Strait of Juan de Fuca.

GEORGIA, University of, a State institution of higher learning at Athens, Ga., chartered in 1785. It was formally opened in 1801 and is the oldest State institution of the United States. In 1872 it received the proceeds arising from the sale of lands granted to Georgia under an act of Congress passed in 1862, and since that time it has greatly increased its facilities. The institution comprises the State College of Agriculture; Franklin College; North Georgia Agricultural College, situated at Dahlonega; the law school; the medical college, situated at Augusta; the Normal and Industrial School for Girls, situated at Milledgeville; the School of Technology, situated at Atlanta; the State normal school, and the industrial college for colored persons. It has a library of 65,000 volumes, a faculty of 171 members, and an attendance of 1,800 students.

GEORGIAN BAY, an inlet from Lake Huron into Canada, extending into the south part of the Province of Ontario. It is about 120 miles long and 50 miles wide. The deepest water, which is in the southwestern part, is about 300 feet. Manitoulin Island and the peninsula of Cabot's Head partly separate it from Lake Huron, with which it is connected by North Channel and a short channel south of Manitoulin Island.

GERA (gā'rà), a city of Germany, capital of the principality of Reuss, on the White Elster, 44 miles southeast of Weimar. It is regularly platted and well built. The chief buildings include the post office, the palace of the prince, the theater, and a number of schools. It has manufactures of woolens, carpets, jewelry, cigars, brick, leather, and machinery. The streets are well paved with stone and macadam. It has extensive systems of waterworks, sewerage, and electric urban and interurban railways. Gera dates from the 12th century and became a possession of the house of Reuss in the 14th century. Population, 1905, 46,909; in 1920, 49,965.

GERANIUM (jĕ-rā'nĭ-ŭm), the name of a flowering plant, popularly called *crane's bill,* which constitutes the typical genus of the order *Geraniaceae.* A number of species are cultivated for their flowers, of which the *spotted crane's bill* is the largest. It has a stem about two feet high and bears light purple flowers. Most species have a bitter rootstock, which is used in medicine, when it is known as *alum root.* They thrive best in rocky places, on sandy shores, and on the slopes of mountains. By cultivation a large number of plants with beautiful flowering qualities have been originated. The geraniums commonly cultivated are grown as flowering plants and are known in botany as *Pelargoniums.* They are native to the southern part of Africa, especially to Cape Colony. These have been widely acclimated and are popular for window culture and greenhouse decoration. They are easily propagated by cuttings, and bloom almost continuously under proper care.

GERANIUM.

GÉRARD (zhā-rär'), **Baron François Pascal,** noted painter, born in Rome, Italy, March 11, 1770; died Jan. 11, 1837. His most noted work is a historical painting of the "Battle of Austerlitz." Louis XVIII. made him court painter and promoted him to the rank of baron.

GERARD, James Watson, diplomat, born at Geneseo, New York, in 1867. He graduated at Columbia University in 1900 and from the Columbia Law School in 1902, and shortly after became associate justice of the supreme court of New York. President Wilson made him ambassador to Germany in 1913, where he served until 1917, when he was recalled on account of the war.

GERHARDT (zhā-rär'), **Carl Friederich,** famous chemist, born in Strassburg, Germany, Aug. 21, 1816; died Aug. 10, 1856. After securing a liberal education at Carlsruhe and other schools, he settled in Leipzig. He developed the doctrine of homologous series, originated the theory of types, and devised an improved system of notation in chemistry. His chief work is entitled "Traité de chimie organique."

GERHARDT (gĕr'härt), **Paul,** famous poet and theologian, born in Saxony, Germany, March 12, 1607; died June 7, 1676. In 1668 he was appointed archdeacon of Lübben in the duchy of Saxe-Merseburg. He ranks as an eminent Lutheran divine and is the author of many songs still popular in Protestant churches. His productions include 123 excellent hymns, many of which have been translated into various languages. The most celebrated and widely

translated include "Now All the Woods are Sleeping," "Jesus, Thy Boundless Love for Me," and "O Sacred Head Once Wounded." His collected songs were published in 1666 under the title "Spiritual Songs."

GERMAIN (jĕr-mān'), **Henri,** financier, born in Lyons, France, in 1824; died Feb. 2, 1905. He was educated in his native city and at an early age entered public life. In 1869 he was elected to the legislature for the department of Ain, was afterward prominent in the chamber of deputies, and in 1885 was elected a member of the Academy of Moral and Political Sciences. His reputation is based chiefly on the great banking institution which he founded, known as the Crédit Lyonnais. This organization has branches in all parts of the world and is based upon the business principle that deposits are to be securely invested and that they may be utilized at any time when it is necessary to realize on them.

GERMAN EAST AFRICA, formerly a colony of Germany, on the east coast of Africa, with a coast line of 620 miles. It is bounded on the north by British East Africa, east by the Indian Ocean, south by Portuguese East Africa and British Central Africa, southwest by Rhodesia, and west by the Congo Free State. The northern boundary crosses Lake Victoria Nyanza, the western boundary passes through the middle of Lake Tanganyika, and the northeastern part borders on Lake Nyassa. It includes the Island of Mafia, in the Indian Ocean. The area is 384,176 square miles.

A narrow coastal plane extends along the Indian Ocean, whence the surface rises gradually toward the interior, where the country assumes the aspect of a wide plateau with an altitude of from 3,000 to 4,000 feet. A range of highlands extends through the central part, trending north and south, where some of the mountains have a height of 6,000 feet. The highest elevations are in the northern part, where the volcanic peak of Mount Kilimanjaro rises to a height of 19,720 feet, forming the highest point in Africa. Many streams water the country, most of which is drained into lakes Victoria Nyanza and Tanganyika, which have their outlet through the Nile and the Congo. Few of the rivers, such as the Rufiji and the Panzani, are navigable by small boats, but many streams are available for irrigation. The climate is tropical and plant life is numerous and luxuriant. Malaria prevails in the lowlands, but the more elevated regions are healthful. The annual temperature is 78° along the coast, although it is somewhat higher in the lowlands of the interior. Rainfall is excessive in some parts.

The colony has extensive deposits of coal, salt, iron, and petroleum. Gold and silver are found in the southwestern part, but mining has not been developed to a large extent. Agriculture is the chief occupation. The products include coffee, rice, wheat, tobacco, maize, cotton, and tropical fruits. Sugar beets are grown successfully in many parts of the colony. The domestic animals include cattle, horses, sheep, and goats. Timber, India rubber, tobacco, and live stock are the leading exports. Textiles, hardware, and machinery are imported. The principal ports are at Dar-es-Salaam, Lindi, Tanga, Kilwa, and Pangani. Several lines of railroads have been built, including one from Dar-es-Salaam inland, and the Cape-to-Cairo Railway is projected through the east central part.

The administration is under a governor, who is appointed by the crown and assisted by a legislative council. Dar-es-Salaam is the capital and leading seaport. Schools are maintained under the government in the leading towns, with higher instruction at Tanga, Bagamoyo, and Dar-es-Salaam. The first German settlement was made on the eastern coast of Africa in 1884, but the territory was turned over to the German East Africa Company the following year, under which trade and colonization were promoted. The Sultan of Zanzibar renounced his claims to the coast in 1891, when the colony came under the control of Germany. About 1,500 of the inhabitants are Europeans. The region was transferred as a mandatory to Great Britain in 1919. Population, 1922, 19,875,105.

GERMANICUS CAESAR (jĕr-măn'ĭ-kŭs sē'zĕr), Roman general, born in 15 B. C.; died in 19 A. D. He was a son of Claudius Drusus Nero and accompanied Tiberius on his campaign into Dalmatia and Pannonia. In 14 A. D. he was made commander in chief of the army on the Rhine, and, when the rebellious legions offered him the sovereignty, he refused to accept the crown and remained loyal. However, Tiberius feared his popularity and recalled him. He was sent into Syria in the year 19 to engage the Parthians and the Armenians, but was poisoned by Piso, the governor of Syria, while near Antioch. He was the father of Caligula, the emperor, and of Agrippina the Younger, mother of Nero.

GERMAN OCEANICA (ô-shĕ-ăn'ē-kà), the portion of the Pacific Ocean which lies between the Coral Sea and the Marianne Islands and extends from the northern part of eastern New Guinea to the Gilbert Islands. It includes the northeastern part of New Guinea, or Kaiser Wilhelm's Land, Dampier Island, Long Island, the Bismarck Archipelago, part of the Samoan or Navigator Archipelago, two chains of the Lagoon Islands, the Eastern Carolines, part of the Solomon Islands, the Pelew Islands, the Western Carolines, part of the Marianne Islands, part of the Gilbert Islands, the Admiralty Islands, and a number of others. These islands have a considerable trade, but their administration requires imperial aid. These possessions were transferred by the Paris Peace Congress, in 1919, to be a mandatory of Great Britain.

GERMAN SILVER, an alloy of nickel, copper, and zinc in varied proportions. This alloy was first made at Hildburghausen, Germany, of 2.6 parts iron, 25.4 parts zinc, 31.6 parts nickel, and 40.4 parts copper. The proportions commonly used at present are one part zinc, one part nickel, and two parts copper. It is whiter and harder than silver and takes a high polish. Strong acids attack it and some organic acids, such as vinegar, affect it materially. It is used largely in the manufacture of forks and spoons, knife and fork handles, candlesticks, and watch cases.

GERMAN SOUTHWEST AFRICA, formerly a colony of Germany, bounded by Portuguese West Africa on the north, British South Africa on the east, and by Cape Colony and the Atlantic Ocean on the south and west. The area is 322,450 square miles. Among the chief rivers either wholly or partly in the region are the Orange, Cubango, Cunene, and Zambezi. Walfisch Bay receives the water of the rivers draining the interior. It contains the most important harbor, besides which are Swakopmund, Lüderitz Bay, and Sandwich Harbor. About 480 miles of railroads are in operation. The mission schools are attended by 5,650 students.

The coast region is sterile, but the interior is susceptible to cultivation and yields agricultural products, cattle, horses, hides, and ostrich feathers. Deposits of copper and other minerals are found in paying quantities. Since the war between the Boers and British a considerable number of Boer agriculturists settled in the fertile regions of the interior and are aiding in rapidly developing its productive resources. German merchants established trading posts on the coast in 1883. Several insurrections have been raised by the native Hereros, but they were finally subdued in 1906. Other native tribes include Hottentots, Bushmen, and Bechuanas. Windhoek, on Wolfisch River, is the capital and has railway connection with Swakopmund. The colony became a British mandatory in 1919. Pop., 1922, 247,715.

GERMANTOWN, a town which was annexed to Philadelphia, Pa., in 1845. It was the scene of an important battle between the American army under Washington and the British under Howe, on Oct. 4, 1777. Howe occupied Philadelphia and sent a detachment to seize forts Mercer and Mifflin, which caused Washington to make an attack at Germantown, where he hoped to crush the British. Early in the morning two columns of the American army advanced upon the village under Sullivan and Greene, but the Americans were thrown into a state of confusion on account of a heavy fog which occasioned a mistake and led Greene to charge upon the left center of the American army, causing a panic and the loss of the battle. Washington conducted a retreat in good order before the advance of Cornwallis, who had hurried from Philadelphia with two battalions. The American loss was 673 men and the British lost 575. Germantown was settled by Palatinate Germans in 1683. They established the first paper mill in America at this place in 1690 and published the first American edition of the Bible in 1743. At present it is a pleasant part of Philadelphia, about six miles north of the center of the city, and has fine gardens and superior buildings.

GERMAN UNIVERSITIES, the term applied to the more important institutions of learning founded in the German-speaking countries, but located principally in Germany, Austria, and Switzerland. These institutions are the most efficient and constitute the greatest organizations of institutional learning in the world. Twenty-one of these institutions are in Germany, of which thirteen are Protestant, four are Roman Catholic, and four have mixed faculties. This system includes 4,820 instructors and professors and about 48,500 students, and numbers among the alumni some of the leading thinkers and writers, both living and dead. The institutions maintained in Berlin, Munich, Leipzig, Bonn, Freiburg, Halle, Breslau, and Göttingen are the largest. However, the University of Heidelberg is the oldest, having been founded in 1386. Those classed as Roman Catholic are at Freiburg, Munich, Münster, and Würzburg and those having both Protestant and Roman Catholic faculties include those at Bonn, Breslau, and Tübingen. All the courses of study articulate with those of preparatory schools, though foreigners are admitted to membership without examination on certificates from foreign institutions of recognized merit.

The discipline is rigid and expulsion from one university constitutes a bar to admission to the others. In the higher courses are included medicine, philosophy, theology, and law, though the natural sciences, civics, higher pedagogy, music, political economy, civil and electrical engineering, architecture, and other departments are maintained. The studies are largely elective, which gives students the privilege of pursuing such advanced work as seems best adapted to their needs, while they may enroll contemporaneously in different institutions for the purpose of taking additional and supplementary work. These universities are under the control of appointees of the government, who constitute, with the minister of public instruction, the managing, directing, and guiding officers for particular institutions.

The expense of maintaining these universities is borne largely by the state, only about ten per cent. being paid by students in the form of fees. Among the university museums, libraries, and publications those of Germany take high rank. In all the great centers of learning are adequate requirements to facilitate references and home reading, while the

scientific societies, especially those which foster original research, are represented by a wide range of organizations. Instruction is mostly by lectures, the preparatory work being done largely in laboratories and during private hours. Students may secure lodging and board in private families, but ample facilities are provided at the dormitories and may be utilized at small expense. Most of the courses cover four years of work, though in medicine it is often five. The class of degrees issued depends largely upon previous preparation. A large proportion of the students are from foreign countries, including many from America, for whose accommodation advanced and special postgraduate courses are maintained in some of the institutions.

The leading German universities of Austria-Hungary are at Vienna, Graz, Innsbruck, Czernowitz, and Prague, but the last mentioned maintains a faculty in Bohemian. Basel, Bern, Geneva, Lausanne, and Zurich have the chief German universities of Switzerland. The alphabetical list of the universities of Germany is as follows:

Berlin,	Jena,
Bonn,	Kiel,
Breslau,	Königsberg,
Erlangen,	Leipzig,
Freiburg,	Marburg,
Giessen,	München,
Göttingen,	Münster,
Greifswald,	Rostock,
Halle,	Tübingen,
Heidelberg,	Würzburg.

GERMANY (jĕr'mȧ-nĭ), **(Deutschland)**, an independent government of Europe, situated in the north central part of the continent. From east to west it extends through 17° of longitude, about 750 miles, and its breadth is 600 miles. Its northern boundary is formed by Denmark and the North and Baltic seas; eastern and southern by Russia, Poland, Austria, and Switzerland; and western by France, Belgium, and Holland. The coast on the North and Baltic seas has a length of 1,200 miles, which is equal to about one-third of the entire frontier. The position occupied by it brings it in closer touch with the leading nations of Europe than any other country and the leading highways of the continent pass through it. It has a total area, exclusive of the ceded territory, of 212,028 square miles, about one-sixteenth of that of all Europe.

Surface. The northern one-third is a low plain and the remainder of the empire may be classed as highland. In the southwestern part, on the boundary of Switzerland, are the high elevations of the Alps. Toward the north of these, extending far into central Germany, are the Mittelgebirge, or Secondary Mountains, and north of these are the low plains. No great elevations exist, the highest being the Bavarian Alps, of which Zugspitze, in Bavaria, is the culminating peak. It has an altitude of 9,675 feet. Other elevations include the Vosges, 4,710 feet, and Feldberg, in the Black Forest, 4,910 feet. The Harz Mountains are near the central part, forming the northern elevations of the highland. Toward the south of these are the Black Forest, the Bavarian Forest, and the Swabian and Franconian Jura. Connected with them by lower ranges are the ridges of the Erzgebirge, the Böhmerwald, the Riesengebirge, and the Fichtelgebirge. All of these elevations have rounded summits and in and through them extend broad valleys of great fertility. Numerous streams water the highland and fine grasses and forests are abundant. Many inlets characterize the shore, but the good class of harbors are confined to the mouths of rivers, where the streams have worn channels through the rather shallow sea. The lowlands form a somewhat sandy plain, which is diversified by elevations attaining heights of about 750 feet. In the northeastern part are many lakes, including a number of inlets known as Haffs, of which Kurisches Haff and Frisches Haff are the most important. In the southern part are Chiem See, Ammer See, and Lake Constance, the last mentioned forming a part of the boundary with Switzerland.

Drainage. Three drainage basins characterize the surface: those of the Danube, of the North Sea, and of the Baltic Sea. They are penetrated more or less by tributaries of navigable streams and the valleys are formed of loam mixed with sand. The greater portion is drained toward the north into the North and Baltic seas by the Vistula, Oder, Elbe, Weser, Ems, and Rhine, each of which receives the inflow from numerous tributaries. Its southern part, especially Bavaria, is drained by the upper Danube and its numerous affluents into the Black Sea. The Memel and the Pregel drain the extreme northeastern part, and the Vistula, which rises in Russia, flows through the eastern section into the Gulf of Dantsic. The Rhine, in the western part, has its lower course in Holland and is the most important highway of commerce. The rivers are largely connected by canals and furnish a vast network of means to navigate the interior, while many jetties have been constructed to deepen and improve the rivers.

Climate. Germany has a temperate climate and the high elevations of the southern part render it quite equable. The colder section is in the northeastern part, bordering on the Baltic, and the warmer region is in the basin of the Rhine. Ice obstructs navigation a part of the year at the ports of the Baltic, but those of the North Sea are open practically the entire year, where the climate is influenced noticeably by the warm winds from the Atlantic. The

mean temperature for the year is about 70°, ranging somewhat above that in the southern part and a little below it in the northern part. All sections of the empire have an abundance of rain for the germination and growth of all classes of plants common to the Temperate Zone, though it varies considerably according to locality and season. The heaviest precipitation is in the vicinity of some of the mountain ranges, where it reaches 40 inches, while the northern section has from 25 to 30 inches. Heavy storms and winds do not prevail, but the northern part has a heavy snowfall.

Flora and Fauna. Nearly one-fifth of the empire is covered with forest, consisting chiefly of deciduous trees, and these receive as much care as the cultivated fields. Among the chief species are oak, elm, beech, fir, and pine. Coniferous trees are most abundant in the eastern part, and the beech may be said to be the most prominent tree in the eastern section. More than seventy per cent. of the entire area is under cultivation, either for agricultural or horticultural purposes.

Small game is abundant in the forests and wolves and wild boars are found in reservations and some of the mountains. The wild goat, marten, fox, otter, deer, chamois, and badger frequent the Alpine region, and the elk and fallow deer are protected in the preserves. The region of plains in the north is frequented by aquatic birds, such as the duck, snipe, and goose, which migrate there from the northern seas. Storks are abundant and are frequently found in the high buildings of cities, where they are protected by government regulations. The coast and stream fisheries are very valuable and produce merchantable quantities of the clam, eel, trout, salmon, carp, tunny, and oysters.

Mining. The geological formations are diversified, the principal characteristics being the recent sand loam deposits of the northern portion, Jurassic rocks in the central part, and Palaeozoic rocks in the southern section. Mining is an important enterprise, especially in coal and iron, in which Germany takes third rank, being exceeded only by Great Britain and the United States. These minerals are widely distributed over the country, especially in the southwestern part, and the output comes largely from Bavaria, Baden, and Upper Silesia. A large number of the mines are owned and operated by the government. Formerly bituminous and anthracite were mined exclusively, but the larger demand for fuel in the manufactories has caused a large output of lignite coal. Prussia is a heavy producer of copper, lead, zinc, nickel, and cobalt, though these minerals are distributed more or less over the empire. The silver mines take rank as the richest in Europe. Rock and other salts and potash salts are abundant. Other minerals include limestone, granite, sandstone, petroleum, and ocher. The quarries yield a large output for building purposes and monumental work.

Agriculture. About two-thirds of the surface is in a high state of cultivation and is used either for pasturage or the growing of crops. Though one-third of the people engage in agriculture, the products are not sufficient to supply the demand. Great care is exercised in cultivating the soil, and many of the hillsides and mountain slopes are terraced to make husbandry possible. A large majority of the farms are small, ranging in extent from five to twenty acres, and the number that exceed 300 acres is comparatively insignificant. Modern methods are employed in all departments of farming, and a large number of steam plows, seeders, self-binding harvesters, and steam threshers are in use. This is accounted for largely by the increase of manufacturing enterprises, which have been the means of producing and introducing newer methods.

Rye is grown most extensively of the cereals, and is cultivated on about three times more land than either wheat or barley, though these can be raised profitably in all sections of the empire. Oats take second rank among the cereals. Corn is grown chiefly in the southern part. The acreage of hay is about equal to that of rye, being an important crop on account of the extensive interests in dairying. Germany has first place in the production of sugar beets and in this product has made greater progress than any other country, the enterprise being encouraged by bonuses paid by the government. The vine is a staple product along the Rhine, Main, Moselle, and in Swabia and Brandenburg, and the Rhine wines are famous in the markets of the world. Garden vegetables of all kinds, flax, tobacco, hops, barley, spelt and rape are cultivated extensively. All classes of domestic animals thrive, but the largest share of attention is given to raising cattle for their meat and dairy products. Next in the order of importance are horses, sheep, swine, and goats. The Prussian studs and the Holstein cattle have a wide reputation.

Manufacturing. Germany ranks as the third manufacturing country of the world, being exceeded in the output only by Great Britain and the United States. About forty per cent. of the entire population are engaged in manufacturing enterprises, which include about 275 distinct industries. In the production of beet sugar it takes first rank, and it is classed among the leading nations in the output of steel and iron manufactures. However, the largest per cent. of persons engaged in any of the manufacturing industries are employed in making clothing, and those next in order are the building trades and the manufacture of foods. The textile industry furnishes a very large share of the commodities exported, especially the preparation of flax and the weaving of linen fabrics, although the output of cotton and

woolen goods takes high rank. Other enterprises of this class include those of the velvet, silk, carpet, lace, and damask industries. Large interests are vested in the manufacture of toys, scientific instruments, armor plate, hardware, sailing vessels, spirituous liquors, earthenware, leather, paper, and heavy artillery pieces and projectiles. Large shipyards are located at Hamburg, Stettin, Bremen, Kiel, and Dantzic. Germany has extensive interests in the manufacture of rubber and gutta-percha goods, carved wooden specialties, clocks and musical instruments, and glassware.

Transportation. Germany had an extensive system of transportation even before steam and electricity came into use, which consisted of well-improved highways, canals, and navigable streams. The Rhine, Elbe, Weser, Oder, and Vistula are navigable, and these and others have been materially improved by the construction of jetties and canals. Among the principal canals are the Finow, 40 miles long, in Brandenburg; the Ludwig's, 110 miles, in Bavaria, which unites the Black Sea and the North Sea by connecting the Danube and the Main; and the Kiel and Ider Canal, 21 miles, which unites the North and Baltic seas. The Great Canal extends from Kiel to the Elbe, facilitating the movement of the largest vessels, and is now used extensively for commerce between the North and Baltic seas. The Kaiser Wilhelm Canal affords a short outlet from the Baltic to the Atlantic.

Germany has 38,943 miles of railway lines and is exceeded in railroad mileage only by Canada and the United States. These lines are owned principally by the national government, or by that of the states, and they are operated as public enterprises. Berlin is the most extensive railroad center in the empire, but lines penetrate every section of the country. In addition there are a large number of electric railways, both in the cities and throughout many parts of the country. The government maintains an efficient mail service and systems of telephone and telegraph lines. Stone and macadamized highways are numerous and in good condition.

Commerce. The foreign commerce of Germany is exceeded only by that of France, Great Britain, and the United States. The annual imports aggregate $2,428,210,250 and the exports, $1,641,713,500, being less than the combined exports and imports of the United States, which aggregate $9,137,391,433. Textiles, chemicals, coal, machinery, scientific instruments, leather goods, and clothing are the chief exports, while the imports consist principally of breadstuffs and raw materials. The greater share of trade is with Russia, Great Britain, the United States, Austria-Hungary, France, Argentina, India, Belgium, the Netherlands, Italy, and Switzerland.

Colonies. The development of colonial possessions before the war was a national policy. Its colonies included Kamerun, German East Africa, Togoland, German Southwest Africa, Kaiser Wilhelm's Land, the Ladrones, the Carolina Islands, the Marshall Islands, Kiauchau in China, the Bismarck Archipelago, the Pelew Islands, the Marianne Islands, the Solomon Islands, and part of the Samoan Islands. These possessions had an area of 1,027,950 square miles and a population of 12,500,000, and were governed through a centralized bureaucracy. Trade with the colonies had increased steadily with each decade, the imports amounting to $12,500,000 and the exports from the colonies being $7,500,000, of which the mother country received about fifty per cent. The expenditures on account of the colonies were somewhat larger than the receipts, though the burden was lessened materially by the development of a growing trade.

Education. The educational affairs of Germany are in a prosperous and effective condition, its schools, colleges, and universities taking the highest rank among the nations of Europe. For many years it was the land of pedagogy, in which teachers flourished who gave impulse and enthusiasm to its educational arts, promulgated basic principles vital in the education of man, and paved the way for progress in other lands. Elementary schools, or *Volkschulen,* are supported in all communities, while institutions disseminating knowledge of industry, arts, sciences, and higher education are established and maintained under state and national supervision. The elementary schools include 61,500, in which 125,500 teachers give instruction and 8,980,000 pupils attend. Higher education is centered in 21 universities, at the head of which is the University of Berlin (q. v.), and the Lyceum Hosianum at Braunsberg, which has faculties in theology and philosophy. The institutions of secondary learning are numerous, including scientific schools, academies, and gymnasiums. The universities carry courses in medicine, law, theology, and philosophy. Many of these institutions are equipped to teach political and domestic economy, civil and electrical engineering, the natural sciences, and the trades, and all have museums, libraries, and collections of art. The scholars of Germany are renowned for faithful research, patience, and thoroughness, and have given the world many authorities on the important sciences and for professional reference. Newspapers, magazines, and periodicals have a wide circulation and are made up of superior educational, scientific, and intellectual material. Attendance at school is compulsory from six to fourteen. The number of normal schools for the training of teachers is reported at 185.

Government. Germany may be considered the successor of the Holy Roman Empire, which came to an end in 1806. However, Aus-

tria does not belong to the present confederation. The states included at present were the four *kingdoms* of Bavaria, Prussia, Saxony, and Württemberg; the seven *grand duchies* of Baden, Brunswick, Hesse, Mecklenburg-Schwerin, Mecklenburg-Strelitz, Oldenburg, and Saxe-Weimar; the four *duchies* of Anhalt, Saxe-Altenburg, Saxe-Coburg, and Saxe-Meiningen; the seven *principalities* of Lippe, Reuss-Greiz, Reuss-Schleiz, Schaumburg-Lippe, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, and Waldeck; the three *free cities* of Bremen, Hamburg, and Lübeck. The *crown land* of Alsace-Lorraine was ceded to France.

The government is a constitutional republic, based upon the constitution adopted in August, 1919, which recognizes the president as the highest executive officer. It provides that all the states of Germany are to "form an eternal union for the protection of the realm and the care of the welfare of the German people." The office of president is elective and in it is vested the power to represent the republic in concluding treaties and alliances, declaring war, and concluding peace, and the president has chief command of the army and navy. Internal trade is free, while a high protective tariff is in force in relation to other countries, which, with the revenues from railroads, telegraphs, the postal system, and excises, constitutes the chief source of government receipts. The legislative power is vested in the upper and lower houses, which are known as the Bundesrath and the Reichstag. In the former are 58 members, appointed by the several states, and the latter has 397 members, elected by a universal ballot. The term of office in each branch is five years. Revenue bills originate in the lower house. The chancellor is appointed by the president and is the president of the Bundesrath. He has a seat in the lower house by virtue of his office, where he represents and defends the government in public measures and policies. In his general duties he is assisted by eleven secretaries, who are at the head of the several departments of the government. The proceedings of the legislative branch are public. A bill, to became a law, must have a majority vote in both branches, be assented to by the president, and receive the signature of the chancellor. The president is elected for seven years.

The political parties are organized similarly to those of Canada and the United States and include the liberal, conservative, and clerical. The liberal party advocates a united Germany on constitutional lines, the conservatives constitute the imperial party proper, and the clerical, known also as the ultramontane, is the Roman Catholic Party. These, besides the social democratic and several other parties, comprise the leading factors and are maintained by aggressive organization work. The several states have local administrative power and are pledged to a perpetual union, none of which has the power to secede or withdraw from the confederation. The laws of the republic are fundamental and all others must harmonize and conform to them.

Every male citizen of sound health and constitution formerly served three years in the federal army, in the reserve four years, and in the militia or landwehr five years. No one could be represented by a substitute, but the three years' compulsory service was reduced one year by the completion of a course in the gymnasia. The navy has been reorganized within recent years, since the Great European War, and now comprises a comparatively small number of vessels suitable for coast defense and for patrol duty. The total naval force is limited to 13,500 men. The peace footing is 100,000 men and officers; the war footing, 3,450,000 men. As a whole the army and navy are well organized and thoroughly disciplined, but the Treaty of Versailles reduced both to ineffective forces.

Inhabitants. The people of Germany are classed as Low German and High German. This classification includes, respectively, the people of North and South Germany, the term being applied on account of the difference of elevation in the different sections. Emigration from Germany has exceeded that of any other country, except Ireland. The number of Germans in the United States is about 8,000,000, exclusive of the American descendants who have lost the identity of language. The total number of German people residing in other countries is about 50,000,000, of which the greater number reside in the United States, Austria, Switzerland, Belgium, Russia, and Australia, and they are otherwise distributed to various sections of the world and in colonies. About 65 per cent. of the population of the empire are Protestants and 35 per cent. Roman Catholics, the latter being resident most largely in the Rhineland, Bavaria, and Baden.

In 1905 the population was officially reported as 60,641,278, and in 1921 it was reported at 63,003,500. It ranks next to Russia in population of the European countries, but its density is greater, being about 310 to the square mile.

Nineteen cities have a population of over 200,000. These include Chemnitz, Charlottenburg, Stettin, Düsseldorf, Essen, Magdeburg, Bremen, Hanover, Nuremberg, Frankfort-on-Main, Cologne, Dresden, Breslau, Leipzig, Königsberg, Munich, Hamburg, Stuttgart, and Berlin. In 1920, Berlin, the capital, had a population of 2,070,695, and Greater Berlin, which includes a number of suburbs, had a population of 3,709,504. The remarkable growth of German cities within recent years is accounted for by the vast increase in the manufacturing enterprises.

Language. The German language is a branch of the Indo-European group of languages. It is commonly divided into three parts, known as

Old High German, Middle High German, and New High German. In this classification the word "high" has a mere geographical distinction, and is used to distinguish from the German spoken in the low countries, which is known as *Plattdeutsch*. As to time the periods are classified to include the years 600-1100, from the rise of the Franks to the Crusades; 1100-1500, from the Crusades to the Reformation; and from 1500 to the present. While the different provinces still have a somewhat variant dialect, the official language and that taught in the schools is universal, and there is a constant tendency to unify the spoken tongue in all parts of the region where the German language is officially recognized. The language is especially rich in synonyms, making it prolific in words to express emotion and adapting it to the purposes of the orator and poet. There is little difference between the German alphabet and that of the English, but the orthography and pronunciation differ considerably. While the grammar is more complicated by the fuller inflection and conjugation of words, it is notable that the orthography is much more in line with natural sounds, and as a result spelling and pronunciation are less difficult.

Literature. The year 600 A. D. is fixed as the time when Gothic influence began to decline and the Franks took the lead in German history. After gaining control of Middle and South Germany, they embraced Christianity. Collections of folklore and legends were made as early as the time of Charlemagne. That distinguished sovereign not only encouraged literary art, but also made a collection of popular German poetry, mostly songs. The age of the Minnesingers, or singers of love, began about 1200, when companies of poets visited the castles and courts of nobles, where they sang the story of King Arthur and the history of Troy. To this period belong the "Nibelungenlied" and "Gudrun," in which the story of the heroic combats of Siegfried is related, and in them is a detailed account of how Griemhild, the beautiful daughter of King Gunther, was won by the gallant Siegfried. They relate the story of sinking the Nibelungen treasure in the Rhine, detail the death of Attila the Hun, and give a glowing account of the death of Hagen at the hands of Griemhild.

Another epoch is marked by the introduction of the mysteries and passion plays. These plays attained to the height of popularity in the 15th century, and not only gave rise to the German drama, but still continue in such interesting exhibits as are periodically witnessed at Oberammergau. Though all these and Walther von der Vogelweide, the greatest of the Minnesingers, had an extended influence upon the language and literature, it remained for Martin Luther to institute the era known as that of the New High German. This he did by translating the Bible into the German, thereby giving the language a fixed literary value, and he also wrote many songs which still engage the attention of singers in many tongues. Hans Sachs (born in 1494) was a contemporary of Luther, and his permanent place in literature is due to the 6,048 poems from his pen.

Johannes Fischart (1545-1591) is the author of numerous works, including "Christian Education," "The Luckship," and "The Marriage Book," the last named depicting the joy and peace of home life. To this epoch belong the popular stories written by the same author known as "The Wandering Jew" and "Eulenspiegel." The 17th century witnessed a period of great revival in learning and culture. At this time were translated many of the classics, while biography, romance, history, and philosophical works received marked attention. Martin Opitz (1597-1639) is the author of "German Poetry," a work celebrated on account of its purity in language and diction. Other writers of this period include Paul Gerhardt (1607-1676), one of the greatest hymn writers.

German literature in the 18th century became quite free from foreign influence, and exercised a marked impression in Switzerland and the low countries. Johann Gottsched (1700-1766), is the most eminent literary man of the early part of the 18th century, and may be regarded the most eminent philologist prior to Grimm. His chief writings include the drama, "Dying Cato," while Johann Jakob Bodmer (1698-1783) translated "Paradise Lost" and published the "Nibelungenlied." Frederick Gottlieb Klopstock (1724-1803) is one of the noted poets of this period and the author of a religious epic entitled "Messias," while Christoph Wieland (1733-1813) takes high rank with the cultured poets. His best known productions include "Oedron," a tale of fairy lore, and he made numerous translations from Shakespeare. However, the most eminent poet of this period is Gotthold Lessing, who not only published comedies and tragedies of much value, but greatly benefited literature by elevating style through efficient criticism. His writings include "Nathan the Wise," "Hamburg Dramaturgy," and "The Young Scholar." J. G. Herder (1744-1803), a contemporary of Lessing, is noted chiefly for his searching criticisms. Among the eminent writers of the latter part of the 18th century are J. W. von Goethe and J. C. F. Schiller, two of the most distinguished characters in German literature. The names of these two writers are inseparably linked to each other, and their productions rank with the most eminent in the world's literature. See **Articles.**

The system of public schools and universities of Germany placed the literature on a high plane, a result to be expected from the fact that its scholars are recognized the foremost in the world. Among the philosophical writers are such eminent men as Schelling, Haeckel, Kant, Fichte, Hegel, Lotze, Schopenhauer, and von

Hartmann, whose productions have been widely translated. The historians include Niebuhr, Ranke, and Mommsen; the biblical writers, Strauss, Schleiermacher, Paulus, Neander, De Wette, and Baur, while Humboldt, Agassiz, and Max Müller, who wrote both in German and in English, hold eminent places as naturalists and scientific inquirers. Heinrich Heine, Ludwig Uhland, August von Schlegel, Ferdinand Freiligrath, and H. Fallersleben are classed with the later poets, Karl Gutzkow (1811-1878) and Gustav Freytag (1816-1895) are among the novelists, and George Ebers takes rank as an Egyptologist and general writer, producing among others "Cleopatra," "In the Blue Pike," and "Barbara Blomberg." The satirists include Jean Paul Richter; the humorists, Fritz Reuter; the dramatists, C. F. Hebbel, and the miscellaneous writers, Gottfried Keller, Paul Heyse, and Wilhelm Jordan. The Grimm brothers are noted for their eminent services to philology.

German literature includes the best known authoritative works on music, and the master musicians have so fully touched the hearts of the people that their names are known in all civilized lands. These include such eminent composers as Mozart, Bach, Beethoven, Haydn, and Handel, in the 18th century, and Meyerbeer, Mendelssohn, Weber, Wagner, Schumann, Schubert, Liszt, and Franz Abt (1819-1885), in the 19th century. Among the eminent educational writers are Froebel, author of "Education of Man;" Henry Pestalozzi, writer of "How Gertrude Educates Her Children;" and Kant and J. F. Herbart, two well-known philosophers and writers of works on psychology. Among the eminent writers of the 20th century are Hermann Sudermann (born in 1857), who takes high rank as a novelist and dramatist, among his productions being "Dame Care," "Sodom's End," "Love in a Grove," and "Honor." Gerhart Hauptmann (born in 1862) is famous as a dramatist, his works including "Weavers" and "Sunken Bell." Other writers of this period include the historians, Ludwig Hartmann, Hans Prutz, Paul Hassel, and Johann Penzler; the literary critics, P. Schwanke, Karl Federn, B. D. Diederich, and M. Neckar; and the writers of fiction, Max Dreyer, Wilhelm Polenz, Hermann Stehr, William Armenius, and Paul Lindau.

History. The German people are descendants of the Indo-Germanic or Aryan race. In history they are first mentioned in the year 113 B. C., when they came in contact with the Romans. At that time they occupied a region east of the Rhine and north of the Danube, and were divided into numerous separate and independent tribes, being bound together by language and racial ties. In the time of Alexander the Great the Germanic tribes of the Baltic coast were met with, but the first authentic history of them appeared in the "Commentaries" of Julius Caesar in 58 B. C. The Celtic name given to these tribes was *Germani* and was the name used by the Romans, but the term by which they designated themselves was the present name *Deutsch,* meaning people. There were about fifty tribes, most of which were united in the 1st century and succeeded in overthrowing Roman control, driving the legions of Varus from their possessions. In the year 200 A. D. the Germanic peoples invaded the territory of the Romans and threatened their capital. Later the different tribes formed numerous groups, the most powerful being known as the Frisians, Burgundians, Saxons, Goths, and Franks. Soon after the Huns, who were pressing them southward, caused them to cross into the Roman Empire, and for many years they controlled more or less of the former Roman possessions.

The Franks under Clovis defeated the Roman governor in 486 and established their seat of government near the present site of Paris. After subduing the Alemanni, Visigoths, and other minor tribes, Clovis became the ruler of Gaul, and, after his death, in 511, these possessions were divided among his four sons. The dynasty of Clovis was known as the Merovingian and controlled the destiny of the German tribes until the rise of Charlemagne, who became emperor in 800, founded the Carlovingian dynasty, and gave rise to a long line of kings and emperors who for more than 1,100 years occupied the throne of Germany. The empire of Charlemagne, known as the Holy Roman Empire, was reared on the ruins of Rome. It brought about marked changes in the civilization and intellectual status of the Germans, and impressed them with a nationalism sufficient to endure, though it was suppressed at intervals. The vast empire was divided among the successors of Charlemagne and subdivided successively until many small principalities with potentates having absolute power came into existence. In 887 the French and Germans became finally separated, at which time there existed five powerful divisions among the Germans. These constituted the Bavarians, Saxons, Lorrainers, Swabians, and Franks, of whom the last were the most powerful, and in 911 succeeded the descendants of Charlemagne in the government of Germany. Duke Henry of Saxony is counted the founder of the German Empire, since he was the first to establish a government distinctly German, and largely strengthened the five dukedoms by greatly reforming the military system, building fortresses, and providing for internal improvements. The Saxons reigned about one hundred years, during which time the Wends rose in rebellion in 928 and the Magyars in 933, and other local differences occurred. However, the Saxons maintained their sovereignty and were followed by the house of Franconia, which ruled until 1125.

Conrad II. was the first Franconian king.

He ruled energetically in 1024-39 and succeeded in subduing the nobles and establishing an alliance with Canute, the celebrated Danish king. In 1138 the Hohenstaufen dynasty began its reign with Conrad III. (1093-1152), who ranks as one of the most celebrated kings of mediaeval history. The reign of this dynasty is noted because of prolonged conflicts between the imperial powers and that of the Pope and for the organization of the early Crusades, Frederick, surnamed Barbarossa, being the most celebrated in this line. The first Crusade was undertaken in 1095. In the second, organized in 1147, Conrad III. took a conspicuous part. He amalgamated the strength of his nation into a vast army, but both he and his soldiers perished in an attempt to reclaim the Holy City, his death occurring in the third Crusade, after a reign of fourteen years. The Hohenstaufens governed until 1273, when the Carlovingian line became extinct, and the next king was chosen by the nobles, who, after long contests, decided upon Rudolph I., founder of the Hapsburg dynasty, which is still the ruling line in Austria. Within the period of his reign the royal authority was largely extended, important conquests were made in southeastern Germany, and the influence of the princes was curtailed largely.

In the reign of Albert of Austria, in 1298-1308, began the prolonged revolutionary movements for the independence of the Swiss cantons. Within the succeeding century occurred sanguinary contentions among rival claimants of the throne, and in 1415, in the reign of Sigismund, terminated the persecutions of the followers of John Huss, who was burned at the stake on a charge of heresy, but this event was only a forerunner of the Reformation. Luther began to preach the Protestant faith under Maximilian I., and the reign of Charles V., from 1519 to 1556, fully grounded that faith in Germany. The seeds of civil discord germinated during the great religious movements resulted in the Thirty Years' War, which began its depressing ravages in 1618.

The weakened condition of commerce, the stagnation of interior trade, and the heavy burdens of taxation occasioned by the prolonged war brought a desire for the cessation of hostilities, which was first secured by the Peace of Augsburg. However, the terms of the treaty gave offense to various adherents of Luther, Calvin, and the Catholics, and war soon broke out anew. In the meantime Wallenstein led the army against Bohemia for the extermination of the Protestants, and these movements continued until the Swedes, under Gustavus Adolphus, came to the rescue of the Protestants, when the latter obtained his memorable victory at Lützen in 1634. The ascension of Ferdinand III. to the throne, in 1637, made possible the Treaty of Westphalia in 1648, which adjusted religious matters, though Germany was divided into 203 independent states, and each gave only nominal support to the emperor. Besides, Switzerland and the Netherlands were separated from the empire, while Alsace was ceded to France. After the Treaty of Westphalia, Prussia gained strength and became the controlling power in Germany and the stronghold of Protestantism. This led to the rise of the house of Hohenzollern, as the house of Hapsburg was Catholic, giving Prussia marked advantage over Austria. In 1702-13 the war of the Spanish Succession brought marked glory to the rising power of Germany, but it did not operate to solidify and strengthen the internal affairs of the empire. Soon after, in 1756-63, occurred the Seven Years' War, which gave Prussia additional advantages over Austria. Frederick the Great of Prussia strengthened the power of the army, replenished the treasury, and made that country the center of German unity.

The power of Germany was almost destroyed by the wars immediately following the French Revolution. In 1806 Francis II. resigned the title of Emperor of Germany, having assumed that of Emperor of Austria, with which the Holy Roman Empire ended. In 1813 the allied forces of Prussia, Russia, Sweden, and England frustrated the plans of Napoleon to add most of the German states to France, at the Battle of Leipzig, and the vigorous assault of Blücher with 30,000 Prussians destroyed his last hope at Waterloo in 1815. The congress of Vienna now endeavored to restore order and organized a German Confederation, of which the Emperor of Austria was chosen president, Frederick William III. as ruler of Prussia, receiving one-third of Saxony. In 1848 the national assembly, which met in Berlin for the purpose of framing a national constitution, was prevented from rendering material aid by the rivalry of Austria and Prussia, and was followed by a Revolution, but Frederick William IV. restored order by promising a constitution. The growing popularity of Bismarck and his firm rule led to a final union of many of the states.

In 1866 occurred the war between Austria and Prussia, known as the Seven Weeks' War, which was the last great struggle for German unity, and, under the leadership of von Moltke, the Austrians were utterly routed at Sadowa, in Bohemia, on July 3. The Prussians occupied Vienna on August 23, and the war terminated after seven weeks. In the peace treaty which followed Austria was shut out from the federation formed north of the Main River. France, jealous of the rising power of the house of Hohenzollern, found occasion to declare war when Leopold, a member of the family, was offered the crown of Spain. War was declared on July 19, 1870, and the South German states were enthusiastic from the first in supporting Prussia, while the northern

states showed an equal degree of interest in the cause of unity. Two powerful armies invaded France and by a spirit of marked enthusiasm won battle after battle, captured Napoleon III. with an army of 90,000 men, and sent him to Germany as a prisoner. A siege of Paris caused that city to surrender on Jan. 29, 1871. The treaty which followed required France to pay $1,000,000,000 as a war indemnity and cede Alsace and the German portion of Lorraine to Germany. The most important result of the war with France was the solidification of the German states, the development of a spirit of nationalism, and the restoration of the old empire. King William was proclaimed emperor with the title of William I. on Jan. 18, 1871, before leaving the capital of France.

Among the subsequent events of the empire are its constant growth of influence, colonial expansion, the building of great railroads and canals, and vast improvements in economic and social life. The triple alliance formed by Germany, Austria, and Italy on March 9, 1888, strengthened the peace aspect of Europe and was renewed by Caprivi, the chancellor who succeeded Bismarck. William I. was succeeded by Frederick, his son, on March 9, 1888, but the new emperor suffered from a cancerous affection in the throat and died June 15, and was succeeded by his son William II. Among the event of this administration are the passing of Count Von Bismarck, the controversy in China because of the murder of Count A. Von Ketteler (1853-1900), the expansion of German commerce, and the issues of the Great European War.

When Austria- Hungary declared war against Servia, July 28, 1914, Germany became involved in the issues and soon after declared war on Russia, France and Belgium, while Great Britain, Servia, Japan and other nations declared war against Germany. Thereupon Germany was invaded by Russia from the east, but soon repelled the invaders, and at the same time sent successive armies through Belgium into France. By the 2nd of September the German forces penetrated as far as Chantilly, on the Marne River, where they were halted and compelled to retreat as far as the Aisne River. Here they intrenched themselves and for four years resisted the combined armies made up chiefly of French, British, Belgians and later Americans. The tide turned rapidly in 1918, when they were defeated in Belgium and France and were compelled to fall back as far as Metz, Mons and Brussels. An armistice was signed Nov. 11 and the Peace Treaty of Paris, signed at Versailles June 28, 1919, ended the war.

Emperor William II. abdicated before the armistice had been signed and found a retreat in Holland. Frederich Ebert was chosen the first president of the republic. Upon his death, in 1925, Paul von Hindenburg was elected president. In the peace treaty Germany lost all the colonies and other territory and was obligated to pay $43,-800,000,000 and make other reparation. See **War,** page 666, last volume of this set of books.

GERMINATION (jĕr-mĭ-nā′shŭn), in botany, the sprouting of a plant from a seed. It depends upon the seed coming in contact with moisture and warmth at the proper time. Few kinds of seeds will grow after keeping them for five or six years, while some must be brought in contact with the ground as soon as they ripen, and others may be kept safely for fifty or sixty years. It is impossible to tell whether the germ of a seed will grow, and this can be determined only by placing it in a condition under which it will germinate.

A seed consists of two parts, the *embryo* and the *cotyledons.* The former is a miniature plant and the latter is the food stored to promote its growth. Seeds differ in the number of cotyledons; corn and rye have but one, the bean and pea have two, while the pine and a number of others have more than two. When the seed is brought in contact with moisture and warmth, it swells a little and the tiny stem of the embryo begins to lengthen and soon bursts through the coats of the seed. Later the two leaves straighten and grow larger and the seed coats are thrown off, leaving the plantlet stand in the soil. It must be observed that the little stem which first comes out of the seed turns downward and points into the earth, giving rise to the roots and rootlets, while the other end of the stem turns upward and lengthens into the stalk and leaves. It is not known why the roots grow downward and the stem turns upward, though some botanists assert that these phenomena are due at least in part to the rotation of the earth upon its axis.

The seedling plant is complete in all parts at the time of germination and it develops into a matured organism through growth. It has all the organisms of vegetation found in any plant before blossoming, and its life and development depend upon nutriment derived from the soil and the air. As the root begins to branch out into *rootlets,* a little bud called the *plumule* appears on the top of the stem, just between the stalks of the two seed leaves, and it enlarges and develops into a leaf. This leaf is soon raised upon a new piece of stem, which carries it upward a short distance, and another leaf soon appears on the summit of this joint of stem, and is likewise raised upon its joint of stem. At an early stage of growth the plant obtains food wholly from the cotyledon, later it is nourished partly by the cotyledon and partly by the soil and air, and in due time the nourishment is derived entirely from the soil and air and the cotyledon, which has now become useless, falls off, though in some plants it is consumed entirely by the young growth.

The nourishment in the cotyledon consists in its starch and albumen, but neither is available

for use by the plant until it has been acted upon and made soluble. This takes place when it becomes moist, causing fermentation, through which the starch is changed to dextrin and sugar. Chemical changes of this kind cause a rise of temperature, but fermentation does not set in unless the moistened seed is subjected to sufficient warmth. About 85° Fahr. is the best temperature, though it may vary according to the nature of the seed. Germination takes place in wheat in temperatures ranging from 41° to 108° and in corn from 48° to 115°, while the most favorable temperature for the former is 85° and for the latter 98°. Corn having one cotyledon, the cotyledon remains under ground and is absorbed by the plant. This is true also of the pea, both of which have a true leaf at the beginning. In the bean, which, like the pea, has two cotyledons, the cotyledons appear above the ground and there undergo certain changes, furnishing nutriment until they cease to be necessary, when they fall to the ground.

Germination of a Maple Seed, showing successive stages from the seed to the plant with leaves and rootlets.

GERMS. See **Bacteriology; Germ Theory of Disease.**

GERM THEORY OF DISEASE, a view according to which a specific germ exists for each definite disease infectious to the various organs. The theory implies that these germs of living organisms are communicated from an infected person, principally by food, drink, or air, and grow and multiply in the body they come in contact with, producing the disease of which they are characteristic. The particles of contagious matter retain their vitality during definite periods; this, like their growth and promulgation, varies in the different forms. It has been demonstrated that they succumb when subjected to a temperature of 200° to 300° Fahr., and to a low temperature of from 30° to 75° below zero, though in each case the infectious matter must be exposed for a definite time. In the 17th century Hauptmann, a German physician, expressed the view that invisible germs existing in the air may cause epidemic diseases, and all the more important discoveries in relation to contagion have been made since that time.

The living germs are grouped as microörganisms and vary greatly in size and form. They multiply largely by fission, especially the bacterium and micrococcus. The former is rod-shaped and about one ten-thousandth of an inch in length, and the latter is round in form and about one thirty-thousandth of an inch in length. Other forms are the vibrio, spirillum, and bacillus, the last mentioned being formed like rods, slightly larger than the bacterium, and multiply by spores and divisions. Animals having died from splenic fever contain blood laden with swarms of bacilli, which multiply and throw off spores that can be cultivated, and the production may be continued through different classes of fluids. A rabbit or guinea pig can be inoculated with artificially developed contagion, and death ensues from the same disease as that of the animal from which the contagion germ was taken. For many centuries tubercles were known to be hereditary and were regarded noninfectious, but the tubercular bacilli have been discovered.

Dr. Koch, of Berlin, cultivated the bacillus organism and communicated it to animals, in whose bodies it was found after death. In 1876 he published an important treatise on the life history of this form of germ life, and in 1882 announced his discovery of a microörganism in tubercles which he regarded the principal, if not the only, cause of consumption of the lungs. Later he demonstrated that the expectorations of consumptive patients contain microbes which multiply by spores and infect other persons with the disease, even after having dried, in which form they are scattered in the air and breathed in the regular course of respiration. In 1883 Dr. Koch discovered peculiar bacilli in cholera patients. These organisms are formed like a comma and are found in large numbers in the intestines of persons who succumb to the cholera epidemic.

The germ theory of disease was investigated by Pasteur, who also supported it, and contributed much valuable information regarding several forms of bacilli. Germs enter the body and give rise to disease through various channels, particularly through the mouth, nose, eye, ear, and broken surfaces of the skin. The mucous membranes are especially susceptible to certain species of germs, as the mucous membrane of the intestine to the bacillus of typhoid fever and that of the respiratory tract to the bacilli of pneumonia and diphtheria. At first the effect is feeble, but the germs multiply rapidly and soon cause direct local and injurious results. A general knowledge of the conditions of life of the various kinds of organisms has greatly decreased the spread and harmful effect of contagion, while pending investigations prom-

ise valuable and specific discoveries of more particular and complicated forms.

GÉRÔME (zhā-rōm'), **Jean Léon,** historical painter, born in Vesoul, France, May 11, 1824; died Jan. 10, 1904. He studied at Paris under Paul Delaroche, traveled extensively in Italy and the East, and in 1863 was made professor of painting in the Paris School of Fine Arts. The picture entitled "Age of Augustus" was purchased by the French government in 1855 and made him a high reputation. This and many others of his productions have been reproduced largely as photographic copies and excel in beauty of coloring and delicacy of touch. His other well-known paintings include "Slave Market in Rome," "Promenade of the Harem," "Roman Gladiator in the Amphitheater," "Bacchus and Cupid," and "Cleopatra and Caesar." He made many fine productions in sculpture, of which the best known is "Pygmalion and Galatea."

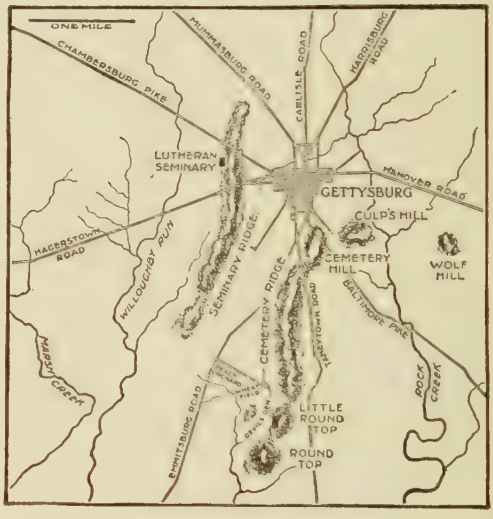
GERONIMO (jĕ-rŏn'ĭ-mō), a chief of the Apache Indians. Nothing is known of his early history. He first sprang into prominence in 1884, when he organized a raid against the settlers of Arizona and New Mexico. Gen. George Crook was ordered to proceed against his band in 1886, when he agreed to terms of peace and was sent to Fort Bowie along with a number of his band, but all of them escaped. General Miles superseded Crook and conducted a vigorous campaign against the Indians. Geronimo was captured and sent to Fort Pickens, Fla., and died at Fort Sill, Okla., in February, 1909.

GERRY (gĕr'rĭ), **Elbridge,** statesman, born in Marblehead, Mass., Jan. 17, 1744; died in Washington, D. C., Nov. 23, 1814. He engaged in commercial enterprises at an early age, accumulated a considerable fortune by close devotion to business, and became a member of the general court of Massachusetts Bay in 1773. In 1776 he was a member of the Continental Congress, where he signed the Declaration of Independence, but, owing to his views against a strong central government, opposed the Constitution. He was chosen a member of Congress in 1780, and was reëlected in 1783 and 1785. The Anti-Federalists elected him a member of the first national Congress in 1789 and reëlected him in 1791, and in 1797 he was commissioner with Marshall and Pinckney to form a commercial treaty with France. In 1811-12 he served as Governor of Massachusetts, during which term he removed members of the opposing party from office and appointed Democrats in their place. He advocated redistricting the State into Congressional districts in a manner intended to benefit his own party in the selection of Congressmen, from which the name *gerrymandering* became applied to the establishment of legislative districts for partisan advantage. In 1812 he was elected Vice President of the United States, but died before the expiration of the term.

GERRYMANDER (gĕr-rŷ-măn'dĕr). See **Gerry, Elbridge.**

GETHSEMANE (gĕth-sĕm'ā-nē), a place about three-quarters of a mile southwest of Jerusalem, at the foot of Mount Olivet, and contiguous to the garden noted as a favorite resort of Christ and his disciples. In this garden Christ retired the night before the crucifixion and suffered the agony mentioned in the New Testament. Its exact location is not known definitely at present, but is pointed out to tourists in a locality where a number of olive trees stand in an enclosure.

GETTYSBURG (gĕt'tĭz-bûrg), **Battle of,** a celebrated battle that occurred July 1-3, 1863, at Gettysburg, Pa., about 36 miles southwest of Harrisburg. It is considered the turning point in the Civil War. The Union army was under the command of General Meade and the Confederates were commanded by General Lee, each numbering about 80,000 men. The latter had invaded the Shenandoah Valley, crossed the Potomac at Williamsburg in the latter part of June, and was pressing forward to Harrisburg.



VICINITY OF GETTYSBURG.

General Meade had just superseded General Hooker in command of the Union forces, and his plan was to engage the enemy at Pipe Creek, but this was frustrated by the Confederates' attack on Reynolds' division at Gettysburg on July 1, when General Meade hastened forward to his assistance.

The battle raged for three days with fearful carnage. On July 3 the Confederates made their last charge on the Union army, but met with fearful slaughter and were repulsed. As a result, Lee was obliged to retreat with his shattered columns across the Potomac into Maryland. The Union army lost 23,190 and the Confederate nearly 30,000, the losses on both sides including many generals and officers. The

successes for the Federals at Gettysburg and Vicksburg occurred at the same time. Both being decisive, they greatly added to the enthusiasm of the North. The national cemetery at the town of Gettysburg was dedicated by President Lincoln, Nov. 19, 1863, and the government erected a fine monument in its center at a cost of $50,000. In this cemetery are the graves of 3,580 Union soldiers.

GEYSER (gī'sẽr), a word derived from the Icelandic name *Geysir,* meaning to burst or gush forth, and applied to intermittent hot springs in various portions of the earth. The most notable specimens include those in the Yellowstone region of the Rocky Mountains, New Zealand, Tibet, the Azores, and those of the southwestern division of Iceland, thirty miles northwest from Mount Hecla. About 100 separate geysers are active within a small area of Iceland, situated within a radius of two miles. They throw out jets of hot water through steaming apertures at intervals lasting five or six minutes, though some throw jets continuously for a half hour. However, the Great Geyser and the New Geyser are the largest. The former has an opening about eight feet in diameter, and throws up columns of hot water to the height of 75 to 100 feet. In the upper portion the opening is about 50 feet in diameter, which is gradually widening. Its action is preceded by subterranean noises resembling the firing of cannon, a slight movement of the earth's crust, and, after throwing up immense volumes of water, steam begins to take its place. After a time the fountain ceases to act, but the process is renewed after a short intervening period. The New Geyser, or Strokkur, as it is called by Icelanders, is supposed to be connected with Mount Hecla, which is, perhaps, true of all those in that region. The phenomenon is explained by Tyndall in that he thinks the water is brought to the boiling point under pressure, after which it explodes into steam, and this, occuring periodically, gives rise to the intermittent ejections.

The geysers in the Yellowstone region of the Rocky Mountains are the most picturesque and powerful yet discovered. About 50 distinct geysers are located within an area of 30 square miles in the vicinity of the Fire Hole River, and throw up water jets from 50 to 200 feet, though some jets rise to about 250 feet. Of these geysers Old Faithful is the most celebrated. It has an opening six feet in diameter, and at intervals of 50 minutes throws water to a height of from 75 to 150 feet. Another wonderful geyser is the Beehive, which acts once every 24 hours, and throws up a jet 175 feet. The geysers of New Zealand are situated in the hot land district of Auckland and present wonderful phenomena. In this vicinity are numerous natural terraces that form reservoirs for cisterns, and near them are thermal springs and boiling geysers. Several are characterized by emitting continually dense volumes of steam. Geysers occur only in volcanic regions. They are connected more or less closely with earthquakes and volcanic disturbances. Geologists generally hold the view that their action tends to relieve the interior. It furnishes an outlet for matters under the action of heat or pressure, and in this manner counteracts and greatly modifies the more extensive volcanic disturbances.

GHATS (gȧts), or **Ghauts,** the name of two chains of mountains in Hindustan, located in the eastern and western sections of that country. The chain of Ghats in the eastern part have an altitude of 1,500 feet and disappear at Cape Comorin. The Ghats in the western part are higher, ranging from 4,000 to 7,000 feet, and extend across India to the Bay of Bengal. They are important in that they form a great watershed and have gold deposits of considerable value.

GHEBERS (gē'bẽrz), or **Guebres.** See **Parsees.**

GHENT (gẽnt), a city of Belgium, capital of the province of East Flanders, 31 miles northwest of Brussels. It is situated in a fertile plain at the junction of the Scheldt and Lys rivers, which are crossed by many bridges, and has communication by numerous canals and railroads. Several of the canals divide it into a number of islands, which are connected by 275 bridges. The city has well-organized public schools and is the seat of a university. Among the public buildings are the Cathedral of Saint Bavon, a Gothic structure built in the 10th century; the Church of Saint Nicholas, begun in the 10th and completed in the 13th century; and the Church of Saint Michael, which contains valuable paintings by Van Dyke. Other buildings include the town hall, the Hôtel-de-Ville, the Palace of Justice, and the Institute of Sciences. It has beautiful parks, gardens, and promenades. The university carries extensive courses of study. It has a library of 115,000 volumes and 750 manuscripts. The manufactures include sugar, hosiery, tobacco, paper, ribbons, vehicles, machinery, and cotton, linen, silk, and woolen goods. It has many flouring mills, machine shops, and railroad car works. The harbor is spacious and furnishes ample moorage for 450 vessels. It has had remarkable prosperity within recent years, owing to its conveniences in navigation and steam and electric railway transportation.

Ghent is first mentioned in history in the 7th century. Baldwin, the first Count of Flanders, erected a fortress on its site in the year 868 to defend it against the Normans. It was made the capital of Flanders in the 12th century and in the 14th supported an army of 75,000 men. By reason of wealth and unity the people of Ghent were able to maintain their liberty and defend themselves successfully against the feudal lords, who came from Burgundy and Spain to encroach upon them. Jacob Van Artevelde led two revolts respectively in 1338 and

1369 against Burgundy, and in 1504 it was deprived of its privileges by Charles V. of Germany. This conquest caused its prosperity to decline, particularly during the reign of Philip II. of Spain. France conquered it in 1792 and made it the capital of the department of Scheldt. In 1814 it was added to the kingdom of the Netherlands, with which it was included until the separation of Holland and Belgium in 1830, when it became a part of the latter. The peace treaty between the United States and England, known as the Treaty of Ghent, was concluded here in 1814. The Germans occupied Ghent in 1914. Population, 1919, 168,970.

GHENT, Treaty of, a treaty between Great Britain and the United States, concluded at Ghent, Belgium, on Dec. 24, 1814. It terminated the War of 1812 and was ratified on Feb. 17, 1815. The British commissioners for negotiating it were Henry Gouldburn, William Adams, and Lord Gambier, and those representing the United States were James A. Bayard, Henry Clay, John Quincy Adams, Jonathan Russell, and Albert Gallatin. The treaty, as signed, provided for the restoration of all conquered territory and for the appointment of commissioners to examine and report to their respective governments on certain boundary questions. Singularly it failed to settle the chief causes of the war, which were the impressment of American seamen, the rights of neutrals, and the participation of citizens of the United States in the Newfoundland fisheries.

GHERARDI (gā-rär'dē), **Bancroft,** naval officer, born in Jackson, La., Nov. 10, 1832; died in 1903. In 1846 he joined the navy as midshipman on the *Ohio,* a vessel of the Pacific squadron, and entered the Naval Academy in 1852. At the beginning of the Civil War he served on the *Lancaster* of the Pacific squadron, was made lieutenant commander in 1862, and served with much distinction at the Battle of Mobile Bay. In 1866 he was promoted commander. By successive promotions he became rear admiral in 1886, and in that capacity supervised the grand review of the naval forces of the world at Hampton Roads in 1893. In 1894 he was placed on the retired list.

GHIBERTI (gē-bär'tē), **Lorenzo,** goldsmith and sculptor, born in Florence, Italy, about 1378; died Dec. 1, 1455. He was trained in the arts of a goldsmith by his stepfather, and later became skilled as a painter and sculptor. At the age of 19 he began painting frescoes in Rimini, when he and seven other artists were selected to compete for the construction of a gate of bronze in Florence. The works of Ghiberti and Donatello were selected by the judges as the best and the contract was awarded to Ghiberti, the latter having chosen for his design "The Sacrifice of Isaac," and completed the gate after working 21 years. Later he executed a second gate which consumed about as much time, and of these two products Michael Angelo expressed the view that they were worthy to occupy and adorn the entrance of Paradise. Among his other works are "Moses on Sinai," "The Fall of Man," and "The Expulsion from Paradise."

GHIRLANDAIO (gēr-län-dä'yō), **Demenico Corradi,** famous painter, born in Florence, Italy, in 1449; died Jan. 11, 1494. He was apprenticed at an early age to a maker of garlands, from which circumstance he was nicknamed the Garland Maker. In 1481 he became a painter and soon won distinction by displaying much inventive power and in producing many superior perspective designs. Among his frescoes are those of the Sassetti Chapel of the Trinity Church and the choir Santa Maria Novella in Florence. His pupils included Michael Angelo, who drew much inspiration and skill from the works of this master. Among his paintings are "Life of Saint John the Baptist," "The Last Supper," and "Nativity of the Virgin Mary."

GHOST, the name applied to an apparition, or the departed human spirit as seen or imagined by the living. The belief in ghosts is very ancient and has existed to some extent in all countries and in every age. Various religious theories are based upon the belief in ghosts, especially ancestor worship, witchcraft, and totemism. The conception of a ghost seems to originate with dreams, a state or condition in which the body is inert and unconscious while the mind is at least partially active. It is not hard to understand that a savage may be suddenly awakened from a sleep, and that his mind has a vivid impression of a dream in which some departed person was thought of, hence the conclusion that the person actually came in contact with the living. Besides, many have regarded death and sleep quite closely related, and instead of believing that the body has departed at the time of death, they look upon it as still existing somewhere in its living form, ready to pass unseen great distances, or to do superhuman acts when brought under the proper influence.

The ancient Egyptians taught that the soul has separate phases and that the *ka,* a phase of the soul, remains near the corpse. This belief was made plausible to them in connection with their art of embalming, since the bodies of the dead were to be preserved indefinitely under the watchful influence of the *ka.* To some a ghost acts with magic, while others look upon such a being as having the spirit manifested at the time the person died. Hence, when the deceased died in peace and contentment, the ghost was thought to have a peaceful disposition, but one who came to death by violence or under great mental agony was thought to have a spirit of the same kind. This caused fear to be felt by those closely associated with the deceased, a view still evident by those who believe certain houses or places to be haunted.

GIANTS (jī'ants), the persons having ex-

traordinary large stature, size, and bulk. History mentions giants and races of giants, but the occurrence of nations of giants is assigned chiefly to the early stages of civilization. Among the races of giants mentioned in historical legendry are the Laestrygones and Cyclopes, while in the English folklore are mentioned the Cornish and Welsh giants. The Bible makes mention of giants in Genesis, vi., 4, in which the sons of Anak, who resided in the vicinity of Hebron, are described by spies as of such gigantic size and proportion that they themselves were relatively as small as grasshoppers. The Bible frequently mentions the Rephaim race of giants and the giants of Emim and Zuzim. In Greek mythology giants are regarded largely as personifications of natural force, and the term became applied to anything possssing unusual or superior power. The natives of Patagonia, South America, have an average height of six feet and are among the tallest of the living races.

While individual giants have lived at various times, there are at present persons who have a height, no doubt, fully as large as any that ever lived. Among the persons attaining to high stature may be named Maximinus, a Roman emperor, who was nearly nine feet tall. Queen Elizabeth had a Flemish porter who was seven feet six inches tall; Cajanus, a giant of Sweden, was nine feet; Patrick Cotter (O'Brien), who flourished in Ireland in 1783, was eight feet eight inches; and the Swedish guard employed by Emperor Frederick William I., of Prussia, measured eight feet six inches. It has been found by careful investigation that giants die comparatively early and have a more feeble mind and body than persons of average stature. Their parts are usually out of ordinary proportion. Among the more prominent differences are broad shoulders and haunches, a small forehead and brain, a large lower jaw and a weak muscular system. The disproportion between the trunk and limbs is greatest. Though the cause for unusual growth in the different parts is not understood, it is known that some portions grow more quickly than others, and often continue to gain in size after other parts have ceased to grow.

GIANTS' CAUSEWAY, a promontory which extends into the North Channel from the coast of Antrim, Ireland. It is a portion of the basaltic formations found in Antrim County and near Londonderry. Large quantities of basalt appear to have been forced outward during the Tertiary period, since which time the intruding rocks have been dissected by erosion, leaving a line of perpendicular cliffs exposed. Some of the cliffs are 500 feet high. The Giants' Causeway is exposed for 300 yards, consisting of many thousands of vertical columns of largely six-sided formations, though many of them have five, seven, eight, or nine regularly formed sides. While the columnar structures vary in size, they range from 20 to 30 inches in diameter.

GIBBON (gĭb'bŏn), the name of an anthropoid ape native to the East Indies. It belongs to the same division as the orangs, gorillas, and chimpanzees, but is smaller and has a more slender form. The arms are sufficiently long to reach nearly to the ground when the animal stands erect. Several species have been studied. The active gibbon is remarkable for its power to swing itself from one tree to another. Other species include the lar, the hoolock, and the white-handed gibbon. These animals, while active in moving about among the boughs of trees, are not able to move rapidly on the ground.

GIBBON (gĭb'bŭn), **Edward,** noted historian, born in Putney, near London, England, April 27, 1737; died in London, Jan. 16, 1794. He was the eldest of seven children, six sons and a daughter. In 1752 he entered Oxford, where he studied fourteen months and adopted Catholicism, but was afterward reconverted to Protestantism while under the care of M. Pavillard, a learned minister of the Calvinistic faith at Lausanne, Switzerland. While at that place, where he spent five years, he studied German and French literature and Latin classics. He pursued with much diligence research in English, which, with his aptness and strong memory, made him a profound thinker and a learned scholar. He returned to England in 1758. Soon after he wrote several works in the French language and in 1763 made a visit to Paris and Lausanne. During the following year he journeyed in Italy. While studying the ruins of the Roman capital and visiting the various places of interest that became prominent during Roman splendor, he conceived the idea of writing his great history.

In 1774 he was elected from Liskeard to Parliament, and for eight years supported the administration of North in its policies relating to America. The first volume of his "Decline and Fall of the Roman Empire" was published in 1776, after laboring seven years. It immediately gave the author a reputation. Subsequently he settled at Lausanne to complete his history, which he did on June 27, 1787, and shortly after retired to spend the remaining years of his life in quiet. His work is a masterpiece of history, glowing with vivid and lively imagination, and is told in a charming narrative style. It is a history of the civilized world for thirteen centuries, portrays the various epochs in which paganism gave way to Christianity, and thus spans a vast chasm between the old and the new. The adverse criticism offered to it is founded on the fact that he gives the early paganism a greater splendor than is thought to be fitting, and curtails the worth and substantial benefit of early Christianity. It is certain that his power of condensation and accuracy in regard to the principal historical facts have not been successfully impeached.

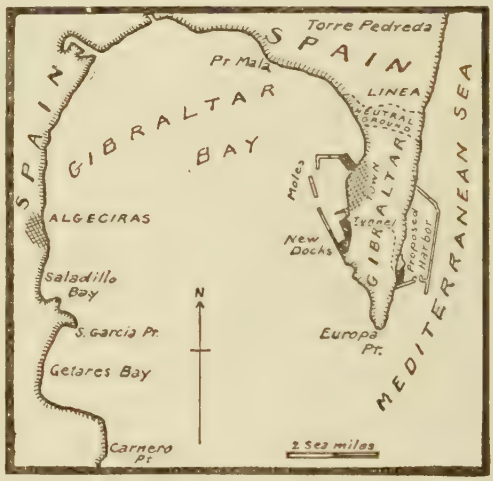
GIBBON, John, soldier, born near Holmesburg, Pa., April 20, 1827; died in 1896. He graduated at West Point in 1847 and immediately entered the army for service in the Mexican War. In 1854 he became an instructor at West Point, where he was made quartermaster in 1856, and at the beginning of the Civil War he joined General McDowell's division as chief of artillery. He took part in the battles of Fredricksburg, Gettysburg, and Petersburg, and in 1876 commanded in the expedition against the Indians under Sitting Bull. The following year he defeated Chief Joseph with 500 warriors in the Big Hole Valley, Montana. He was made brigadier general in 1885 and six years later retired from active service.

GIBBONS, James, Roman Catholic cardinal, born in Baltimore, Md., July 23, 1834; died March 24, 1921. He was ordained priest in 1861 and became assistant pastor at Saint Patrick's church in his native city. Shortly after he was assigned as priest to Saint Bridget's church, later transferred to the cathedral as secretary to Archbishop Spaulding, and soon after became chancellor of the archdiocese. He became vicar apostolic of North Carolina in 1868, with the rank and title of bishop, and was assigned to the see of Richmond in 1872. His appointment as coadjutor to Archbishop Bailey of Baltimore was made in 1877. He succeeded the latter in the same year and became a cardinal in 1886, being the second American receiving this distinction. Among his published works are "Our Christian Heritage," "The Faith of Our Fathers," and "The Ambassador of Christ."

JAMES GIBBONS.

GIBEON (gĭb'e-on), an ancient city of Palestine, about five miles northwest of Jerusalem. It was inhabited by Hivites at the time Joshua conquered Canaan, but they obtained safety and protection from Israel by professing to have come from a far country. When the deception was discovered, the Gibeonites were degraded to the condition of hereditary "hewers of wood and drawers of water unto all the congregation." The five kings of the Amorites besieged Gibeon because it had concluded an alliance with Israel, but Joshua marched against them and it is said that "the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies." Saul persecuted and nearly exterminated the Gibeonites and their land was possessed by the tribe of Benjamin, but later it became a possession of the Levites. The sanctuary was at Gibeon in a part of the reigns of David and Solomon. The village of El-Jib, located on a summit of a hill characterized by massive ruins, is supposed to be the site of Gibeon.

GIBRALTAR (jĭ-brăl'tĕr), a town in the southwestern part of Spain, situated on the west side of a strongly fortified rocky peninsula of the same name, both belonging to Great Britain. The town occupies a site north of the place where the peninsula terminates in Europa Point, on Gibraltar Bay, and has a convenient and spacious harbor. It is a free port, has important commercial business, and is utilized by the British as a distributing station for their manufactures. The principal street is about one mile long, with which others intersect at right angles. It has many large buildings, including barracks, two theaters, a naval hospital, the governor's building, several churches, and the admiralty. The chief export commodity from the town is wine, though there is a considerable trade in fruits, textiles, and machinery. Several remains of cathedrals of Moorish construction are in evidence, and near the town are the celebrated Alameda Gardens. The lighthouse, built in 1841, is situated on Europa Point, casting a light 150 feet above the sea, which can be seen fully



VICINITY OF GIBRALTAR.

twenty miles. The population of the town, including the garrison of about 6,000 men, is 26,382.

The rocky peninsula of Gibraltar rises to an elevation of 1,410 feet. It is three miles long and three-fourths of a mile wide, and is connected with the mainland by a sandy isthmus known as the neutral ground. On the west is the Bay of Gibraltar, and its eastern and southern shore is washed by the open sea. Powerful artillery is planted on the entire rocky precipice. The south side is almost inaccessible, while the precipitous and rugged extremity on the west is made impregnable by powerful batteries. Cav-

erns and galleries sufficient for the passage of carriages have been cut through the solid rock in various angular and parallel lines, and at intervals of twelve yards portholes have been drilled, which serve for firing heavy ordnance. Besides these are numerous caverns, of which the Hall of Michael is the largest, having a height of 70 feet, a width of 90 feet, and a length of 225 feet, with stalactite pillars supporting the roof. The entrance to this cavern is 1,106 feet above the sea.

This precipitous peninsula was known to the Greeks as Calpe. The Saracens, under their leader Tarik Ibn-Zeyad, first fortified it in 711-12, after whom it was called Gebel-al-tarik, from which its present name was originated. Later it fell into the hands of the Moors and was conquered by the Spaniards in 1462, who so strengthened the works that engineers considered it impregnable. After a vigorous bombardment by the Dutch and English forces in 1704, it was reduced and captured. The Peace of Utrecht conveyed it to the English in 1713, in whose hands it has since remained, though desperate efforts to dislodge them were made by the French and Spanish in 1779, but they were completely repulsed after battling in vain for six days. It is no longer the key to the Mediterranean, since modern warships are able to pass it without sustaining effective damages by the guns of the fortress, and, besides, it is not at all likely that the fortress would hold out against modern implements of war. The rocky eminence of Gibraltar and Abjla, now called Ceuta, a precipitous cliff across the Strait of Gibraltar, were anciently called the pillars of Hercules.

The Strait of Gibraltar is a narrow channel connecting the Mediterranean with the Atlantic. It is 36 miles long and has an average depth of 900 feet. At its narrowest point, west of Gibraltar, it is about ten miles wide. A strong and continual current flows in the center of the strait into the sea from the Atlantic, an opposite current passing at the bottom along the coasts, into the ocean. The strait separates the Iberian Peninsula from Africa.

GIBRALTAR, Strait of. See **Gibraltar.**

GIBSON (gĭb'sŭn), **Charles Dana,** illustrator and artist, born at Roxbury, Mass., Sept. 14, 1867. He produced his first sketches in 1886, his earliest being "The Moon and I," which represented the moon and a dog confined by a chain baying at that luminary. Shortly after he painted promiscuously, depicting in a charming manner, and attracted wide attention. In 1892 his "Life Sketch" was exhibited in New York City and the following year he made an extended tour in Europe. "The Collection of Eighty-four Drawings," representing various productions, was published in 1894. Other works were issued successively, among them "Canoeing," "Going in to Dinner with the Duke of Sloppy Weather," and "Reading the Will."

GIBSON, John, sculptor, born at Gyffyn, near Conway, Wales, July 19, 1790; died Jan. 27, 1866. He was apprenticed to a cabinetmaker in Liverpool and at the age of sixteen years found employment in the marble works of that city. His talents in making models and figures caused William Roscoe to furnish him the means for studying two years in Rome, where he received instruction under Canova. In 1822, after the death of Canova, he studied under Thorwaldsen. He resided in Rome the remainder of his life, but revisited England a number of times, and in 1836 was made a member of the Royal Academy. His productions are largely of the Greek mythological type and his subjects of youthful personages are especially praised. His only religious subject, "Christ Blessing the Little Children," is greatly admired. He made a portrait statue of Queen Victoria that is now in the palace of Westminster, in which she is represented to lead the figures of "Justice" and "Clemency." Other works include "Mars and Venus," "Hero and Leander," "Hylos Surprised by Nymphs," "Mars and Cupid," and "Venus with the Turtle."

GIDDINGS (gĭd'dĭngz), **Franklin Henry,** socialist and economist, born in Sherman, Conn., March 23, 1855. In 1877 he graduated at Union College and took up newspaper work, and in 1888 became lecturer in political science in Bryn Mawr. Subsequently he held the chair of sociology at Columbia University, where he taught successfully and at the same time gave much thought to the study of social questions. His works include "Principles of Sociology," "Modern Distributive Processes," "Democracy and Empire," and "Inductive Socialism."

GIDDINGS, Joshua Reed, statesman, born in Athens, Pa., Oct. 6, 1795; died in Montreal, Canada, May 27, 1864. He removed to Ohio with his parents at an early age, was admitted to the bar in 1820, and in 1826 became a member of the State Legislature. He served as a representative in Congress for twenty years, beginning in 1838, being elected each time as a Whig. His Congressional record shows him in the light of an aggressive abolitionist. He was censured by a Congressional vote in 1842 for endeavoring to justify the capture of the *Creole,* a vessel laden with slaves, which caused him to resign and appeal to his constituents, who reëlected him by a large majority. The annexation of Texas and the compromise measure of 1850 met his active opposition. In 1860 he received an appointment as consul general to Canada and died there before his term expired. His speeches were published in a volume in 1853. He wrote a work entitled "Rebellion: Its Authors and Causes."

GIDEON (gĭd'e-on), the youngest son of Joash the Abiezrite, and most celebrated of all the judges of Israel. His country had fallen into widespread idolatry during his youth and was plundered by the Amalekites and Midianites,

and was actually under the supremacy of the latter. As Gideon grew to manhood he developed patriotism and religious zeal, and, when the people had reached a stage of resistance, he began to stir up their enthusiasm. By falling suddenly upon the enemy, he routed them at Mount Gilboa, pursuing them across Jordan into the Syrian Desert. In the forty years of Gideon's reign the Israelites enjoyed peace and prosperity. The epistle to the Hebrews mentions him as a hero of faith. Though offered a kingly crown, he religiously refused to accept it.

GILA (hē'lȧ), a river of the United States, rises in the northwestern part of New Mexico, flows westward through Arizona, and joins the Colorado at Yuma, about fifty miles from the mouth of the latter river. The length is 500 miles. Among its tributaries are the Rio San Pedro, Rio Santa Cruz, and Rio Verde. The Rio Santa Cruz discharges into the Gila only part of the year, being lost in the sand much of the time. Ruins of a prehistoric people are found in the Gila basin, and in its proximity are mines that yield gold and silver.

GILA MONSTER, a poisonous lizard, one of the largest in North America, found in the region of the Gila River and the sandy deserts of Mexico. It is inactive and stupid. The average length of the body is about one foot. At the base of the teeth, which are grooved like those of snakes, are large salivary glands. The bite is fatal to small animals and is considered somewhat dangerous to man. The gila monster is classed with the *heloderma,* a genus of North American lizards, which embraces only two species.

GILBERT (gĭl'bĕrt), **Sir Humphrey,** famous navigator, half-brother of Sir Walter Raleigh, born in Dartmouth, England, in 1539. He studied at Eton and Oxford and was destined for the law by his father, but afterward began a military career. He was given an appointment in the army in Ireland, receiving the honor of knighthood for good service, and later served five years in the Netherlands. His work, "Discourse on the Northwest Passage to India," was published in 1576, and soon after he received letters patent authorizing him to occupy remote regions possessed by heathens and not claimed by any Christian people. He sailed in company with Sir Walter Raleigh in 1578, but met with no success. A second expedition was made by him to Newfoundland, of which he took possession in the name of Queen Elizabeth and planted a colony in 1583, but it did not prosper. While attempting to return to England in the latter year, the ship in which he sailed was lost and he perished in the waves.

GILBERT, Sir John, painter and engraver, born at Blackheath, England, July 21, 1817; died Oct. 5, 1897. He learned the art of illustrating by personal effort without a teacher and later took up painting in water colors. In 1853 he was elected a member of the British Water-Color Society and in 1876 became a member of the Royal Academy. Queen Victoria knighted him in 1871. His productions were exhibited in many expositions, including the Paris Exposition of 1878, where he was made a member of the Legion of Honor. He contributed many drawings to *Punch* and to the *Illustrated London News.* Among his works are illustrations for the writings of Longfellow, Scott, and Shakespeare. His productions include "The Mourning of Agincourt," "Convocation of Clergy," "Don Quixote and Sancho Panza," "Touchstone and Audrey," and "The Education of Gil Blas."

GILBERT, William Schwenck, dramatist, born in London, England, Nov. 18, 1836; died May 29, 1911. He studied at London, served for some time as a clerk in a government office, and was admitted to the bar in 1852. He was on the editorial staff of several periodicals, including the *Fun,* and in 1866 published "Dulcamara," a burlesque. For some time he was associated with Arthur Sullivan, the composer, and worked with him in composing a series of comic operas. These include "Princess Ida," "The Yeoman of the Guard," "The Gondoliers," and "The Mikado." He published independently "Broken Hearts," "The Palace of Truth," and "The Wicked World."

GILBERT ISLANDS, an archipelago in the Pacific Ocean, located on the Equator, almost south of the Marshall Islands. The group includes sixteen small islands, chiefly of coral formation, and the area is 166 square miles. Cocoanut, taro, and various tropical fruits are the chief products. The climate is favorable and the inhabitants are mostly semicivilized, but a number have been converted to Christianity. A part of the islands formerly belonged to Germany, but since 1892 they have been British territory. Population, 1922, 35,036.

GILDER (gĭl'dẽr), **Richard Watson,** poet and journalist, born in Bordentown, N. J., Feb. 8, 1844. He studied at Flushing, Long Island, and afterward took a course of law at Philadelphia. For a short time he served in the Union army during the Civil War and subsequently edited the Newark *Register* and the *Hours at Home.* Later he was editor of *Scribner's Monthly,* which was merged into the *Century,* when he succeeded J. G. Holland as editor in chief. He was a member of many educational and reformed societies. Among his poems are "The New Day," "The Great Remembrance," "Poems and Inscriptions," "In Palestine, and Other Poems," and "A Christmas Wreath." He died Nov. 18, 1909.

GILDING (gĭld'ĭng), the process of applying a thin layer of gold to a surface, such as the surfaces of wood, paper, metal, leather, plaster of Paris, etc. While the processes of gilding differ with the nature of the substance

to be gilded and the kind of effect required to be produced, they may all be classified under three heads: *mechanical gilding, chemical gilding,* and *encaustic gilding.* In a common method of mechanical gilding or oil gilding, from four to ten coats of whiting mixed with white glue are applied, each in turn being smoothed down with sandpaper and a pumice stone. This surface receives the gold leaf, which is put on by means of a brush. A false gilding, although an old invention, is now used extensively to make a cheap and quite durable gilding. The molding is first covered with silver leaf or tin foil and then is coated with a yellow paint.

Metals are usually gilded by a process of electrotyping (q. v.), but, besides this, various methods of chemical gilding are employed. Water or wash gilding consists in applying to metal a wash of an amalgam of gold and mercury and afterward evaporating the mercury by heat, leaving the gold firmly adhering to the surface of the metal. It is worth noticing that this process of gilding is the best form, being more durable than electro-gilding, and is now used in the more costly kinds of decorative work. Fully 30,000 buttons an inch in diameter may be gilded with one ounce of gold. Other methods of chemical gilding are cold gilding, Grecian gilding, and gilding by immersion. *Encaustic gilding* is applied usually to glass and porcelain. An amalgam of gold protosulphide with iron and turpentine, or other substances, is painted on the ware, and the whole is subjected to heat, which fixes the gold, the luster being brought out by burnishing.

GILEAD (gĭl'ē-ŭd), a mountainous region in Palestine, lying east of the Jordan. It became famous because of being allotted to the tribes of Gad, Manasseh, and Reuben, being of much pastoral value for their large herds. The Scriptures mention its fertility in producing grasses and forests, and names Jabesh, Ramoth, and Jazer as its important cities. Among its rivers were the Arnon and the Jabbok. It was rich in aromatic plants.

Gilead was conquered from Sihon and Og and was held against the Midianites, Ammonites, and Syrians. However, it was finally captured by the Assyrians, who carried the people away in captivity. David found an asylum in Gilead during the rebellion of Absalom. Here Ishbosheth, the son of Saul, was proclaimed King by Abner. Jesus visited the region several times.

GILES (jīlz), **William Branch,** statesman, born in Amelia County, Virginia, Aug. 12, 1762; died Dec. 4, 1830. He studied at Hampton-Sidney and at Princeton colleges, and for some years practiced law at Petersburg. In 1791 he was elected to Congress as a Democrat, serving until 1803, excepting one intervening term, and was a strenuous opponent of the United States Bank. In 1793 he made an attack upon the policy of Hamilton, who was then Secretary of the Treasury, and later opposed the Jay Treaty and supported the Virginia Resolution. In 1804 he was elected to the United States Senate, where he supported the party of Thomas Jefferson, but later opposed the policies of Madison's administration. Giles was rated among the best debaters and parliamentarians of his time, but his continuous opposition to measures that proved beneficial caused him to become discredited as a leader. He retired from the Senate in 1815 and in 1827 was elected Governor of Virginia.

GILL (gĭl), **Charles Ignace,** jurist, born at Pierreville, Quebec, in 1844; died in 1901. He received a careful law training in Quebec and began a successful practice of his profession. In 1871 he was elected to the legislative assembly of Quebec, serving until 1874, when he became a member of the Canadian House of Commons. He served as an influential member of that body until 1879, when he was chosen a member of the Supreme Court of the Dominion. He published a number of important documents and works on law.

GILL, Theodore Nicholas, naturalist, born in New York City, March 21, 1837. He was librarian of the Smithsonian Institution in 1865-67, and in the latter year became assistant librarian of the Library of Congress, in which position he served until 1875. In 1884 he was made professor of zoölogy in the Columbian University at Washington, now the George Washington University, later was associate in zoölogy in the United States National Museum, and became president of the American Association for the Advancement of Science in 1897. His publications are very numerous. They include "Arrangement of the Families of Mammals," "Catalogue of the Fishes of the East Coast of North America," "Synopsis of Fresh-Water Fishes," "Primary Subdivisions of the Cetaceans," "Scientific and Popular Views of Nature Contrasted," and "Principles of Geography." He died in 1914.

GILLETTE, William Hooker, actor and playwright, born in Hartford, Conn., July 24, 1855. His father, Francis Gillette, was United States Senator and gave him the benefits of a careful education, including attendance at universities in New York and Boston. He played successfully in these cities and wrote a number of popular plays, which he himself made popular by presentation on the stage. Among his best known plays are "A Legal Wreck," "Held by the Enemy," "Digby's Secretary," and "Secret Service."

GILLS, the respiratory organs of aquatic animals, as fishes, amphibians, mollusks, and crustaceans, serving to breathe the air dissolved in water. In fishes they consist of vascular processes of mucous membrane on either side of the neck. Water is taken into the mouth and forced out through the gill slides, which act upon the blood as it circulates through the

vascular fibrils. The gills in invertebrates are variously situated.

GILMAN (gĭl'mạn), **Arthur,** educator and author, born in Alton, Ill., June 22, 1837. He was educated in Saint Louis and New York, received an honorary degree at Williams College, and in 1871 became an associate editor of the American Tract Society. In 1894 he was chosen regent of the Harvard Annex. He founded the Gilman School, an institution for girls, at Cambridge, Mass., of which he was the director for some time. Among his publications are "History of the American People," "First Steps in English Literature," and "History of Rome." He died Dec. 28, 1909.

GILMAN, Daniel Coit, educator, born in Norwich, Conn., July 6, 1831; died Oct. 13, 1908. He attended the public schools in New England and graduated at Yale University in 1852, after which he traveled and studied in Europe. In 1856-60 he was superintendent of schools in New Haven, and served as State superintendent of schools in Connecticut from 1865 until 1866. In 1872 he was chosen president of the University of California, from which he resigned in 1875 to become president of Johns Hopkins University in Baltimore. He was one of the commissioners appointed by President Cleveland to determine the boundary of Venezuela, and was president of the National Civil Service Reform League. Besides writing many reports and magazine articles, he published "University Problems" and "Science and Letters in Yale." He accepted, in 1901, a position as editor of the "New International Encyclopaedia."

GILMORE (gĭl'mōr), **James Roberts,** author, born in Boston, Mass., Sept. 10, 1823; died in 1903. In 1836 he became partner in a counting-room, and after a successful career established a cotton and shipping firm in New York City, with which he was connected from 1847 until 1857. In the latter year he retired from commercial life to devote attention to literature, and in 1862 founded the *Continental Monthly.* He embarked anew in business in 1873, but retired ten years later to give his attention exclusively to literary work, and became generally known as Edmund Kirke. His writings include "Adrift in Dixie," "Among the Pines," "Rear Guard of the Revolution," "Personal Recollections of Abraham Lincoln and the Civil War," "Campaign Life of Garfield," "John Sevier as a Commonwealth Builder," and "Down in Tennessee."

GILMORE, Patrick Sarsfield, musical conductor, born near Dublin, Ireland, Dec 25, 1830; died Sept. 24, 1892. He took up the study of band music at an early age and in 1847 went to Canada with an English band. Two years later he removed to the United States and played as bandmaster in concerts and circuses at Boston. In 1859 he organized the famous Gilmore's Band, which became noted in America and Europe. During the Civil War he was with a Massachusetts regiment, was assigned to an official position by General Grant, and subsequent to the war played at many musical festivals. He gave concerts at the Paris Exposition in 1887 and while in Europe visited many of the leading cities. Subsequently he traveled through Canada, where he was received with enthusiasm. He was chosen musical director at the Columbian Exposition at Chicago, but died previous to the opening. His compositions include "When Johnny Comes Marching Home," "Ireland to England," and "The Voice of the Departing Soul."

GILOLO (jē-lō'lō), or **Jilolo,** an island of the East Indies, the largest of the Moluccas or Spice Islands, and sometimes called Halmahera. It has an area of 6,350 square miles. The surface is mountainous, the coasts are irregular, and the climate is tropical. Much of the soil is fertile. Among the chief products are spices, sago, fruits, timber, and edible birds' nests. Cattle, horses, and sheep are grown successfully. Galela and Potani are the chief towns. The island belongs to the Netherlands. Population, 1922, 120,108.

GIN (jĭn), an alcoholic liquor distilled from grain and flavored with common salt, juniper berries, oil of turpentine, and various allied substances. In making gin, as in other beverages, each rectifier has his own recipe for regulating the quantities of flavor used. The most renowned article comes from Schiedam, Holland. Alcohol constitutes about fifty per cent. of high grade gin.

GIN, a machine used for raising weights. A common form of the gin consists of three long poles fastened together at one end, having a pulley attached, and the poles are set upright with the lower ends equal distances apart. A rope is passed through the pulley and fastened to a windlass, by the revolution of which the weight is raised. The gin for raising coal and other substances from mines is made by erecting a shaft with a large drum, to which is attached a transverse beam, having a horse hitched at one end. The horse is driven in a circle to raise the weight. The horse power is disappearing rapidly before the steam engine, but the drum is still in common use.

GINGER (jĭn'jẽr), a genus of plants indigenous to the East Indies, but now cultivated in the West Indies, South America and West Africa. The ginger of commerce is obtained from the rootstalk, which is about the thickness of a man's finger. A very noted grade of ginger comes from Jamaica. It is used as a medicine, especially in a powdered form, and in preparing mild drinks, such as ginger ale. In medicine it is used chiefly as a stomachic. Essence of ginger, which is properly a tincture prepared of alcohol and ginger, is of value for flavoring.

GINGHAM (gĭng'ạm), a class of cotton

dress goods woven of plain dyed yarn, usually in checks or plaids. Real ginghams differ from calico in that the colors are woven with the cloth instead of being stamped on after weaving. Although gingham was first made in the East, especially in India, it is now an important article of manufacture in Europe and America.

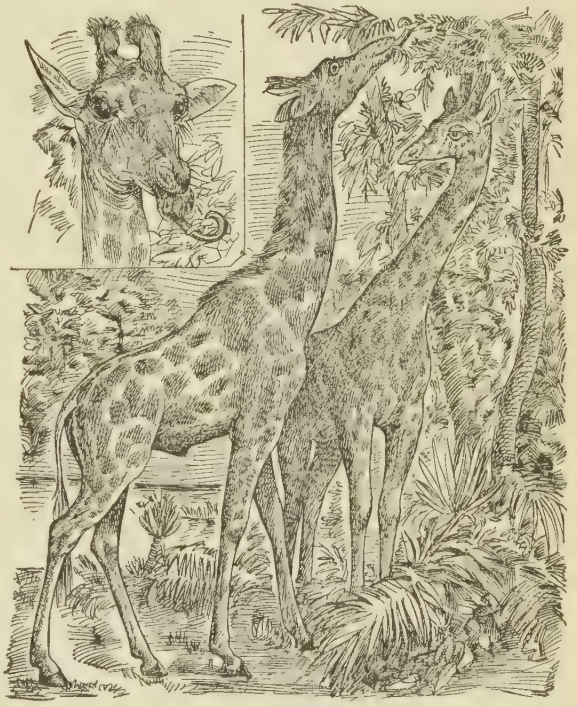
GINSENG (jĭn'sĕng), the root of the *Panax ginseng,* which is native to Asia and North America. It is so named from a Chinese word which signifies *likeness of a man,* owing to the fact that specimens are sometimes found which resemble the human form. These are particularly valuable and often sell for their weight in gold. The ordinary prices range from $2 to $4 per pound. The Chinese employ ginseng for aromatic purposes, but principally as a panacea in cases of bodily weakness, though its virtues are limited. Ginseng is collected in many parts of the United States for exportation. It is cultivated in some places, but not very profitably, since it requires about five years for the root to mature.

GIORDANO (jôr-dä'nō), **Luca,** painter, born at Naples, Italy, in 1632; died Jan. 12, 1705. He was the son of a painter and studied for some time at Rome. In 1679 he visited Florence, where he decorated with frescoes the Corsini Chapel. Charles II. of Spain made him painter to the king, and while in Madrid he decorated the palaces and a number of churches with frescoes. He painted a large number of pictures of various kinds, being rapid in execution and skillful in invention. Among his best works are "Venus and Mars," "David with the Head of Goliath," "Massacre of the Innocents," "The Judgment of Paris," "Lot and His Daughters," and "Saint Francis Xavier Baptizing the Indians."

GIORGIONE (jôr-jō'nā), meaning Great George, eminent painter, whose real name was Giorgio Barbarelli, born in Castelfranco, Italy, in 1477; died in 1511. He studied under Bellini, displayed superior skill, and soon surpassed his master. His productions include many fine scriptural views and pastoral, sylvan, and other idyllic scenes. In Vienna he decorated several important buildings with frescoes. Rare specimens of his portraits are extant, chiefly in the galleries of Milan, Dresden, and Vienna. His best known productions include "Three Philosophers," "Sleeping Venus," "Family of Giorgione," and "The Judgment of Solomon."

GIOTTO (jŏt'tō), **di Bondone,** painter and architect, born near Florence, Italy, about 1276; died Jan. 8, 1337. He was endowed with such natural talent as an artist that he attracted the attention of Cimabue, on account of having drawn lambs of his father's flocks on stone. Accordingly, he was taken to Florence for instruction in art. Twenty-eight frescoes of his earliest works are still preserved. These are particularly valuable on account of being interesting scenes from the life of Saint Francis. His skill consisted largely in the ability to group. He was able to give both simplicity and profound grace, and reproduced with remarkable exactness the beautiful in nature. Dante and other famous men of his time were his friends. As an artist he took high rank. His productions include "Coronation of the Virgin," "A Last Supper," and "Seven Sacraments." The last named is still in a good state of preservation in the Church of Incoronati at Naples. As an architect he executed the dome of Florence and prepared the designs for the Campanile, called Giotto's Tower.

GIRAFFE (jĭ-răf'), or **Camelopard,** the tallest of quadrupeds, constituting a distinct family of ruminants and the only species of its genus. It is a native of Africa, ranging from Nubia to the Cape of Good Hope. Giraffes are gregarious in habit, living in small herds, and feed on the leaves and small branches of trees. They stand eighteen feet or more in height, which is due to the long fore legs and neck. When browsing on grass, the fore legs are stretched apart as far as possible so as to permit the head to reach the ground. The body slopes back, the legs are



GIRAFFE.
Upper view shows prehensile tongue.

slender, and the hoofs are cloven. On the head are two protuberances called horns, which are covered with skin, hair, and bristles. The tongue is very long and prehensile, being employed to grasp food, for which purpose it may be protracted and retracted at will. The hair is short and smooth, of a reddish-white color, and is marked with rusty-brown spots. Their peculiar gait in running resembles a pace. Giraffes are inoffensive, seeking safety in flight, and in captivity become docile and playful. Their flesh is eaten, being quite nutritious, but is not esteemed as food by Europeans. They supply only a limited quantity of milk.

GIRARD (jĭ-rärd'), **Stephen,** philanthropist, born in Bordeaux, France, May 24, 1750; died in Philadelphia, Pa., Dec. 26, 1831. He commenced life as a sailor at the age of thirteen, became captain in 1773, and later conducted important trade enterprises between New York and New Orleans. In 1777 he settled in Philadelphia and engaged in a mercantile career, attaining much success. Shortly before his death he founded Girard College, an educational institution in Philadelphia, by providing an endowment of $2,500,000. In the War of 1812 he rendered valuable aid to the Americans by loaning the government $5,000,000. He became a director of the second United States Bank in 1816.

GIRARD COLLEGE, an institution of learning at Philadelphia, Pa., established in 1848 under a will made by Stephen Girard. It was founded for the purpose of providing facilities to educate and maintain poor white male orphans. Admission is open to students between six and ten years, and they may attend the institution until the age of eighteen years is reached, when they are to be bound out in the arts and trades. The founder provided that applicants for admission are to be given preference in the following order: those coming from Philadelphia; next, Pennsylvania; next, New York; next, New Orleans. Since then the courses of study and the regulations have been modified to provide for the newer conditions which resulted from industrial progress. The institution has 90 professors and instructors, 1,540 students, and a library of 25,000 volumes. The value of the institution aggregates $6,000,000 and the estate from which it is supported is worth $68,000,000. Some of the ablest and most eminent men of America are included in the alumni.

GIRARDIN (zhĕ-rär-dăn'), **Émile de,** journalist and statesman, born in Paris, France, June 22, 1806; died there April 27, 1881. He was the illegitimate son of General Girardin, assumed the name of his father in 1827, and was acknowledged by him in 1848. His first production was a novel entitled "Emile," which is mainly a plea for the rights of illegitimate children. He founded the *Journal* in 1830, a periodical devoted to economics, which soon after reached a circulation of 120,000 copies. Six years later he established the *Press,* a one-cent newspaper which supported the Orleanists in a conservative way. A quarrel on account of politics led to a duel with Armand Carrel, in which the latter was killed. Girardin soon after announced himself a decided republican and promoted the election of Louis Napoleon to the presidency. When Napoleon became emperor, Girardin was in strong opposition and was exiled. Subsequently he returned to France, and in 1862 became the editor of *Liberty,* in which he advocated the Franco-Prussian War. He founded the *France* in 1874 and later the *Little Journal,* both giving support to the new republic. Besides numerous productions of a political nature, he wrote several pieces for the stage, and his wife, Delphine Gray, whom he married in 1831, had a reputation for much ability as a poetess.

GIRARDIN, François Auguste Saint-Marc, journalist and educator, born in Paris, France, in 1801; died April 11, 1873. He studied in Paris, graduating from the College of Henry IV., and traveled extensively in Germany and Italy. His early writings appeared as contributions to the *Journal of Debates.* He was a minister for a short time during the Revolution of 1848, but did not attain to eminence as a statesman. As a lecturer and journalist he ranks as one of the most spirited and skillful of modern France.

GIRDWOOD, Gilbert P., chemist and educator, born in London, England, Oct. 22, 1832. He studied in his native city and in 1854 received a degree from the College of Surgeons in London. For some time he was assistant surgeon in the first battalion of Grenadier Guards and in 1862 went to Canada. He was stationed in Montreal, where he was consulting surgeon for many years in a dispensary and general hospital. Later he was connected with the Royal Victoria Hospital of Montreal. In 1902 he became professor of chemistry in McGill University. He was honored by many scientific and medical associations, and is the author of numerous useful pamphlets and books on scientific and medical subjects. His publications include "Address as President of the Chemical Section of the Royal Society of Canada," "Dislocation of Phalanges," and "Testing for Strychnine."

GIRONDISTS (jĭ-rŏn'dĭsts), a political party of France during the Revolution. They were so named from the department of Gironde, whose deputies were the acknowledged leaders of this organization. Among the chief representatives were Guadet, Brissot, Pétion, Vergniaud, Dumouriez, and Roland. The Girondists were a party of moderate republicans, but their opponents, the Jacobins, charged them emphatically with plotting against the unity of the nation. In 1793 twenty-two of the leaders were arrested, including Madame Roland, who

was an active supporter of the party. Most of them were taken prisoners and beheaded, or died by their own hands.

GISSING (gĭs′sĭng), **George**, novelist, born in Wakefield, England, in 1857; died in 1903. After completing his college education, he engaged as teacher and took up literary work as a professor in London. His first work to attract attention was published in 1884, entitled "The Unclassed." As a writer he assumed a pessimistic vein. Among his writings are "Life's Morning," "The Nether World," "New Grand Street," "Eve's Ransom," "Our Friend the Charlatan," and "By the Ionian Sea."

GIZZARD, a part of the alimentary canal of birds and some invertebrates, whose function is to grind up the food. In this respect it answers the purpose of the teeth in many animals. In birds the gizzard is the second, or true, stomach, in which the food is crushed after it is softened in the glandular stomach, or *crop*, which is situated in the lower part of the esophagus. The interior is lined by a horny epithelium, or shelly plates. The gizzard is assisted in grinding the food by small pieces of gravel and other hard substances, which are swallowed for that purpose by most birds.

GLACE BAY (glās), a city of Cape Breton Island, on the northeastern coast, fifteen miles northeast of Sydney. It is on the International Railway and has a good harbor. The surrounding country contains productive coal mines. It has a large trade in merchandise, machinery, coal, and produce. Among the principal buildings are several fine schools, a public library, and many substantial business blocks. Population, 1921, 17,007.

GLACIAL PERIOD (glā′shạl). See **Glaciers.**

GLACIERS (glā′shērz), the immense masses of ice and snow which move almost imperceptibly from higher to lower levels, found chiefly in the more elevated valleys and slopes of mountains. In the upper parts they consist of soft snow, which is later pressed into compact masses, and at the lower portion the accumulations are constituted of clear, hard ice. The great quantities of snow which form above the snow line press in masses slowly down the slopes. By the pressure, due to the weight of the layers, the air confined in the snow is pressed out, and the lower part of the glacier is thus changed into a compact mass of pure ice. In some cases ice is formed from the snow by successive thawing and freezing, though this phenomenon more or less affects all glaciers below the snow line.

Glaciers resemble rivers, since the solid material which passes into them moves as drainage within their channel. However, the current is much slower, often imperceptible. The larger glaciers, like rivers, have numerous affluents, and peculiarities of flow and velocity. Where tributaries unite and flow on with the main mass, they do not intermingle as the waters of rivers, but the mass coming from each affluent may be distinctly traced throughout the remainder of the course. Owing to the diminished friction at the top and middle portions, these parts move more rapidly than those at the bottom or sides, and in this respect are similar to rivers. On the surface they are usually quite smooth, but at regular intervals in the direction of a valley and in the slope of the bed they are broken into deep fissures called *crevasses*. These occur most frequently at the bend of a valley, where one side is compressed and the other extended, and at such places the crevasses extend obliquely up the stream, and at abrupt descents in the bed directly across.

The crevasses vary from less than an inch to great chasms over one hundred feet in width, and in the larger openings the depth is generally greatest. On the surface the appearance is a dirty white, while down the walls of the crevasses the ice has an appearance of deep azure blue. Where glaciers flow from elevated mountains in the temperate climates, they usually melt in the warm months of the year as they proceed downward, and are thus transformed into streams of water. In this way they frequently give rise to rivers. Among the rivers that have their origin in glacier streams are the Rhine and Rhone of Europe and the Ganges of Asia. The velocity of the ice and the rapidity with which it melts govern the extent of the glacier below the snow line. They retreat up the mountain during an unusually warm summer, following a light snowfall in winter, and, on the contrary, advance further down the valley when heavy snows in the winter are followed by a cool summer.

Glaciers possess much transporting power, and carry to a lower level large volumes of stone and dirt which accumulate on the surface of the moving mass, after rolling down from adjacent elevations. The accumulations are called *moraines*. Generally the moraines are most abundant at the side of glaciers, where they are called *lateral moraines*. At the point where two glaciers unite the meeting edges are marked by a crevasse which is called the *medial moraine*, and at the end of the glacier a *terminal moraine* extends across the valley in a wide curve. Medial moraines one hundred feet in height are not uncommon, while terminal moraines attain to several hundred feet. The erosive power of glaciers is very effective and tends to greatly deepen the valleys through which they move. Evidences of extinct glaciers are found in many localities, and their former existence is attested by deep grooves cut in the bottom and sides of the valleys, and by deposits formed of rock, mud, and bowlders carried by their moraines. When glaciers extend into the sea, like those of Greenland, the base is undermined by the warmer waters of

the ocean and the waves break off great fragments, which form floating mountains of ice called *icebergs*. These are carried into warmer latitudes by ocean currents, where they drop their load of moraine by melting. Icebergs appear most numerously in the north Atlantic, into which they descend from the extensive Arctic glacier region.

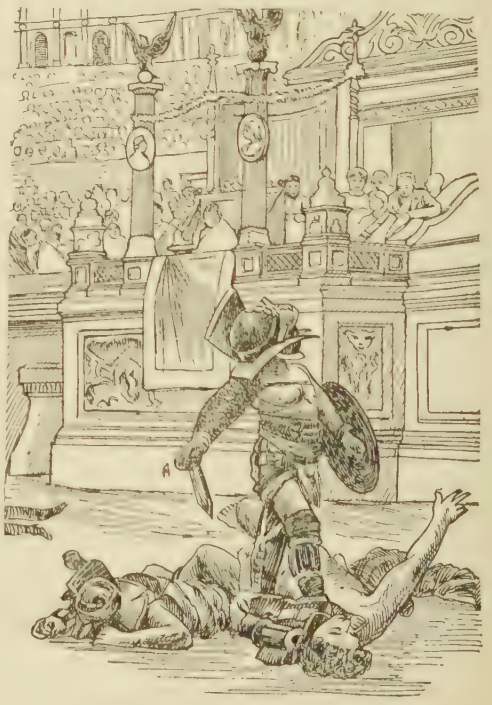
The total number of glaciers in the world is not less than 1,100, of which one hundred are of large size. In the tropical and temperate climates they abound only in the more elevated portions of mountains, while whole continents and islands are apparently covered by them at the poles. Those of the Antarctic regions are probably sheets of ice fully 10,000 feet thick. The Muir glacier, in Alaska, is about 150 miles long and 500 feet deep, and is probably the largest in the world. In the north polar region they abound extensively, but those of Greenland and the islands north of North America are the only ones known to any extent in that region. Others are more or less widely distributed in the continents. Those of the central Alps of Europe have been studied with the best results. The most widely known of these is the Mer de Glace, which rises on the slopes of Mont Blanc and has three large branches, descending into the vale of Chamouni. The longest glacier of the Alps is Aletsck, which has a course of fifteen miles, while the Aar glacier has an estimated depth of 1,515 feet, being regarded the deepest.

The Glacial period, or Age of Ice, is so named from the climatic conditions which prevailed in the Northern Hemisphere at a time when intense cold and sheets of ice prevailed in what are now temperate latitudes. It began in the Newer Pliocene period and terminated before the close of the Post Pliocene, though Arctic conditions prevailed only at intermittent times. The occurrence of great glacial action is evidenced by numerous traces in North America and Eurasia. In the Alpine regions evidences of early glacial action are common, and it is certain that the plants now found on the summits of these mountains were brought down from the Arctic regions at that time. Man existed during the latter part of the two distinct glacial periods traceable in the Alps. The cause of these phenomena in past ages is explained by Sir Charles Lyell by assigning to the north polar regions vast elevations, from which the streams of ice moved southward. Sir John Herschel attributes astronomical reasons, which seem the more probable. The chief cause assigned is the varying eccentricity of the earth's orbit. In 1800 A. D. it was .0168, but 210,000 years prior to that time it was .0567, making the difference of 10,250,000 of miles and the winter days 27.8 in excess. However, the possibility of astronomical causes is militated against by the absence of glacial periods prior to the Newer Pliocene time.

GLADDEN (glăd'dẹn), **Washington**, clergyman and author, born in Pottsgrove, Pa., Feb. 11, 1836. He studied at Oswego Academy and at Williams College, and in 1860 was ordained pastor of the State Street Congregational Church, in Brooklyn. Subsequently he preached at North Adams and Springfield, Mass., and in 1882 became pastor of the First Congregational Church at Columbus, Ohio. He was editor of several papers and wrote many works of more than usual literary value. Among them may be named "Young Men and the Churches," "From the Hub to the Hudson," "Applied Christianity," "Ruling Ideas of the Present Age," "Plain Thoughts on the Art of Living," "Social Salvation," "Working Men and Their Employers" and "Burning Questions." He died July 2, 1918.

WASHINGTON GLADDEN.

GLADIATOR (glăd'ĭ-ā-tẽr), in Roman antiquity, a man who fought with deadly weapons against another gladiator or wild beast, especially in the amphitheater, for the amusement of the



ROMAN AMPHITHEATER.

people. The first gladiatorial fight occurred at the funeral of Brutus in 264 B. C. between his sons, Marcus and Decius. Originally, a gladiator was a prisoner, a slave, or criminal; later the performance became a mere spectacle, and knights, senators, and even women and emperors entered the arena. The gladiatorial exhibits were announced by private circulars or proclamations. Gladiators marched to the arena on the day of the performance, where they were matched in pairs and their weapons were formally examined. In many cases the combats were fought between a man without arms, but provided with a net in which to ensnare his opponent and a three-pronged fork with which to spear him when caught, and an opponent in full armor, who sought safety in evading his enemy while seeking to pursue and kill him. The audience witnessing the combat became frantic with excitement, and yelled and applauded while rising in their seats, shouting their approval when ghastly blows were dealt, followed by blood spouting forth. In most places the arena was protected from the rays of the sun by a gorgeous awning, while strains of music floated in the air, drowning the cries of death. It was not uncommon to distribute Syrian perfumes to overcome by their odor the scent of blood, and the spectators were delighted by the most brilliant scenic decorations.

The gladiatorial battle opened at the sound of a bugle and a shout of command. A gladiator dropped his weapons when severely wounded, and as a plea for life held up his forefingers. This was sometimes in the gift of the people, but more often was vested in the vestal virgins. During the empire the power to spare life was lodged in the sovereign. Mercy was signaled by waving handkerchief or by a turned down thumb, while all hope was forbidden by a clenched and upright fist. Only the brave were accorded mercy. In the time of Julius Caesar it was common to give exhibits by couples fighting. He gave a show in which 320 were engaged. Titus provided an exhibition that continued one hundred days. In it the gladiators fought with wild beasts. The great gladiatorial exhibition of Trajan engaged 10,000 men, who fought with each other and wild beasts, continuing 123 days.

The wild beast fights were the most revolting, and by them many Christian martyrs lost their lives. Among the animals engaged were elephants, rhinoceroses, camelopards, hippopotami, tigers, lions, and many others of a ferocious nature. During naval fights the arena was flooded with water. A naval fight given by Augustus engaged 30 vessels, and during the combat 36 crocodiles were pursued and killed. The combatants were classified according to the arms they carried. Thus, one carrying a shield, helmet, sword, and breast armor was called *samnite;* those carrying a lasso or noose, the *laguearii;* those armed with Thracian buckles and a short sword were known as *secutores.* Gladiatorial games were forbidden in the reign of Emperor Honorius, about 404 A. D.

GLADIOLUS (glă-dī'ŏ-lŭs), a genus of ornamental plants of the Iris order. They have bulbous roots, a tubular two-lipped corolla, a trifid stigma, and ensiformed sheathing leaves. Many species are native to South Africa and Eurasia. The flowers are beautiful and richly colored, and many species have been improved by intercrossing. In color they are greatly variegated and include pure white, violet, crimson, scarlet, and yellow. Each of these is variously modified and shaded. As house plants they are popular, the majority of those cultivated in America coming originally from Cape Colony.

GLADSTONE (glăd'stŭn), **William Ewart,** statesman and author, born in Liverpool, England, Dec. 20, 1809; died May 19, 1898. He was the son of Sir John Gladstone, a Scottish merchant of London, entered Eton in 1821, and in 1831 graduated with marked honors from Oxford. In 1832 he was elected to Parliament from Newark and two years later became Junior Lord of the Treasury under Sir Robert Peel. In 1841 he was made Vice President of the Board of Trade and Master of the Mint, supporting the policies of Peel. While serving on the board of trade, he abolished restrictive tariffs on the exportation of machinery, and in 1844 secured a reduction of railroad rates. His active support of the repeal of the Corn Laws lost him his seat for Newark, but he was returned in 1847 by Oxford University.

WILLIAM E. GLADSTONE.

After the death of Peel, in 1850, Gladstone surged to the front as a financier, and by his vigorous speeches against the budget of Disraeli became noted as one of the most eminent historic orators in Parliament. In 1852 he became Chancellor of the Exchequer, which position he held during the ministry of Aberdeen and a short time in that of Lord Palmerston. His speeches on finance became of much interest to the people and were always looked forward to with enthusiasm. In 1858 he was sent as high commissioner to the Ionian Islands, and about the same time went from the Tories over to the advanced Liberals. He was returned to Parliament in 1865, and, after the death of Lord Palmerston, became the liberal leader of the House of Commons.

Under the leadership of Gladstone a reform bill was passed in 1867 which greatly reformed the suffrage. The following year he carried measures abolishing compulsory taxes to support the church and turned his attention to the distracted condition of Ireland. His seat for South Lancashire was lost in 1868, but he was elected for Greenwich, and the Liberal majority in the new Parliament made him premier. In 1870 the Irish Land Act was passed under his leadership, and shortly after a reformed election law was secured and the Alabama Claims were settled, but in 1874 Parliament dissolved and the Conservative party retired Gladstone from office. We next find him busy with literary and historical researches, but in 1880 he was again made Prime Minister, in which he continued, with only a short interval, until 1886. During this time numerous important laws were passed, among them legislation affecting Ireland, an extension of suffrage, and a reform of the civil service.

His vigorous advocacy of home rule for Ireland resulted in an adverse decision by the people, and he was succeeded by Lord Salisbury. His leadership of the opposition in Parliament continued and resulted in the formation of the Gladstonian party, whose principal tenet was the home rule for Ireland. This issue was submitted to the people in 1892 and again brought Gladstone forward as Prime Minister, but he soon after retired from public service on account of impaired health and old age. Gladstone had implicit faith in the people. He believed that freedom operates to make men better and more competent, and ranked highest as a lawgiver, diplomat, and patriot among the statesmen of England of the last century. Among his numerous writings are "Studies on Homer and the Homeric Age," "Impregnable Rock of the Holy Scripture," "Financial Statements," "The State in its Relations with the Church," "Special Aspects of the Irish Question," "Vatican Decree Bearing on Civil Allegiance," and "State Persecutions of the Neapolitan Government."

GLANDERS (glăn'dĕrz), a contagious disease which affects certain domestic animals and which may be communicated from them to man. It is especially harmful to the animals that have an undivided hoof, such as horses and mules, but swine, cattle, and sheep are subject to it. The disease is due to a specific microbe discovered in 1882. At present no treatment is known under which a cure can be effected, though in rare instances the affected animal may recover. It makes its appearance in swellings of the submaxillary glands, accompanied by a dry cough and discharges from the nose. These discharges cause the disease to spread, especially when left in contact with the harness, stables, vehicles, or the watering places. As the disease advances small bunches or nodules form under the skin, which afterward break open and form ulcers. It is recommended that animals affected with the glanders be killed and that the places frequented be carefully disinfected.

GLANDS, in anatomy, the organs of the body that secrete or separate some particular fluid from the blood. Anatomists divide them into two great classes, known as true secreting glands and ductless glands. *Secreting glands* are special organs, such as the liver, kidneys, and pancreas, and the mammary, lachrymal, and salivary glands. The *ductless glands* include the spleen or milt, the thyroid, and the thymus. An ordinary secreting gland consists of a number of follicles, all of which open into a common duct by which the glandular product is discharged. The follicles are contained in the interior cells, which are the active agents in the secreting process, while their exterior is surrounded by a network of capillaries, from whose contents the materials of secretion are extracted.

In the lower class of animals the glands are quite simple as compared to the same or similar glands in the higher forms of animal life. The *mammary gland,* which is quite complex in the higher mammal, presents a very simple arrangement in the lower types of this class, being merely a cluster of follicles, each of which discharges its contents by its own orifice. The *thymus gland* is located partly behind the sternum and partly in the lower part of the neck, and is largest in infants, disappearing at or about maturity. Its function is to form colorless corpuscles in the blood, and it likely supplies a need in the infant that is cared for by other organs at maturity. Hibernating animals have this gland, which is enlarged by the presence of fat during activity, and appears to supply nourishment and maintain temperature during the period of hibernation. The *sudoriferous* are the sweat glands; the *parotid glands* are the seat of the disease known as mumps; and the *submaxillary, parotid, buccal,* and *sublingual* secrete the saliva. Inflammation and solid swelling are among the diseases that affect the lymphatic glands.

GLASGOW (glăs'kō), the largest and most important city of Scotland, situated on the Clyde River, in Lanark County. The southern part of the site is level, while the northern portion is situated largely on convenient elevations of varying heights. Many of the streets are platted at right angles, being both wide and straight, and the buildings are mostly of freestone. For architectural beauty Glasgow ranks among the best cities of Great Britain. A Gothic cathedral in the northeastern part of the city is the most historical structure. It was commenced in 1240 and completed within 200 years. The length is 320 feet; breadth, 63 feet; and height, 90 feet, with a spire from the center 225 feet high. Among the buildings of modern construction are the Bank of Scotland,

the general post office, the Merchants' House, the Royal Exchange, the Stock Exchange, and the Central Station and the Saint Enoch Station hotels. The institutions of learning include the University of Glasgow (q. v.), Free Church College, Glasgow and West Scotland Technical College, Saint Mungo's College, Saint Margaret's College for Women, and Anderson's College of Medicine. The Mitchell Library, which receives a grant from the city and serves the purposes of a public library, has 125,000 volumes.

George Square, the finest public place in the city, contains many monuments of great beauty, including those of Queen Victoria, Sir Robert Peel, Sir Walter Scott, and the Prince Consort. It has many fine public parks, numerous boulevards, electric lights and street railways, telephone and telegraph connections, and is the junction of numerous railroads. Among the manufactures are woolen, cotton, silk, and linen goods, calico prints, dyed and bleached textiles, iron and steel, machinery, chemicals, pottery, tobacco, sugar, glass, beverages, jute, and leather. In 1895 a central underground railroad was opened for traffic, which affords rapid transit to many parts of the city. Since 1894 it has owned and operated the system of street railways. Practically all of the public utilities, such as the waterworks, meat markets, harbor ferries, and systems of gas and electric lighting, are owned by the municipality.

The importance of Glasgow is due largely to its location near the mouth of the Clyde, which permits navigation by the largest vessels. The interior highlands and adjacent districts are reached by means of canals, railways, and electric lines. Its harbor and docks are very extensive and near them are vast marine-engineering and shipbuilding yards, which are noted for their large output of vessels. In the vicinity of the city are deposits of coal and iron, through which the manufacturing enterprises have been largely facilitated. Glasgow was founded in 560 A. D., when the Celts that populated the region were induced by Saint Kentigren to embrace Christianity and a small church was erected on the site of the great cathedral. However, its prosperity began in 1707, when its commerce became widened and shipbuilding took on large proportions. At present it has seven representatives in Parliament. Population, 1921, 1,112,428.

GLASGOW, University of, an institution of higher learning of Great Britain, located at Glasgow, Scotland. It was founded by Bishop Turnbull in 1451, but was reorganized by acts of Parliament in 1858 and in 1889. The university is governed by a special court, which consists of the principal, the rector, the lord provost of Glasgow, and a number of representatives of the city and university. The chancellor is elected by the general council and holds his position for life, while the rector is appointed for three years by the students. The departments include those of science, art, law, medicine and surgery, and theology. It has a fine botanical garden, an observatory, and a library of 215,000 volumes. The attendance averages about 2,350 students. Many noted scholars and scientists are included in the alumni.

GLASS (glăs), the compound product of silica, having at least two metallic oxides, the most common being those of calcium or lead and potassium or sodium. It is brittle and sonorous at ordinary temperatures, generally transparent or translucent, and is made soft and ductile by heating. The point of melting and fusion varies with its composition. Hydrofluoric acid acts upon it, though ordinary solvents do not. It breaks with a vitreous fracture. Its discovery is not known, though as a commodity of utility and commercial importance it is as old as any known production of man. The Egyptians made use of glass before the Hebrew exodus. Their monuments and ruins bear evidence that they used it for vases, beads, and various ornaments as early as 3250 B. C. The Assyrians, Babylonians, Phoenicians, Greeks, and Romans were all more or less acquainted with and skilled in its manufacture. The vases made by the Romans were among the most beautiful productions of their arts, being finely finished by engraved figures and relief forms, variously colored on shaded background, and sometimes more or less transparent. Among the surviving specimens still preserved is the famous Portland or Barberini vase, though relics of inferior productions of great antiquity are abundant.

The use of glass for windows is much newer than its manufacture for other purposes. It was not utilized in buildings until 250 years after the beginning of the Christian era. Europeans began to use glass extensively to admit light into dwellings and public buildings in the latter part of the 3d century, though for the purpose of lighting churches it was used fully four centuries earlier. The early Puritan settlers of Jamestown, Va., began its manufacture in 1608, and from their rude beginning it has sprung into a vast industry in America. The production in the United States represents a total annual value of about $68,500,000. Practically all classes of glass are manufactured in Canada and the United States and several varieties, such as pressed glass, are American inventions. The principal manufactures of Europe are located in Germany, Belgium, and France, though the enterprise is carried on with more or less success wherever civilization extends. In window glass the American product exceeds all others in quality, while in the finer plate glass and the grade used for optical instruments the manufactures of Europe still exceed those of America. Among the

states producing glass extensively are Pennsylvania, New Jersey, New York, Massachusetts, Indiana, Ohio, and Missouri.

In manufacturing the various kinds of glass different materials are used, such as fine sand or powdered flint, together with salt, alkali, alkaline earth, or metallic oxide. Crown, sheet, and plate window glass are made of silica, lime, and soda. *Flint glass* used for dishes, lamp chimneys, goblets, and bottles is more brilliant and tough than window glass and is made of silica, lead, and potash, though some forms of bottle glass are made of a variety of mixtures containing alumina. Any kind of glass may be *colored* by metallic oxides, though other substances are employed. In applying the coloring matter it may be mixed with the other ingredients while in a melted state, or a partially colored effect may be secured by taking the melted material from two vessels—the one colored and the other transparent—and in manufacturing the product so construct the desired article that a coat of colored glass will cover the other. Alumina and silver produce a yellow color; copper, gold, and oxide of iron, the reddish; cobalt, bluish; oxide of copper and oxide of iron, the greenish; chloride of silver with peroxide of iron, the orange color. To destroy the transparency of glass it may be roughened on the surface, when it is called *frosted glass,* and has the appearance of hoar frost. It is used in buildings where light is admitted, but the view is obstructed. Among the most important properties of glass is its transparency, and, next to it, its effective resistance to acids. When heated, it can be formed into any shape, or may be spun into fine threads and used for ornaments and wearing apparel. It is a very efficient nonconductor of heat. When cold, it is most effectively cut by the diamond.

In glass manufactories the furnace is constructed of fire brick. Two openings are arranged in the furnace; one contains large melting pots and the other is employed to facilitate placing the half-blown product into the heat for softening it. Gas and crude oil are used for fuel, as most other fuels emit too much smoke. The melting pots are of the best fire clay and cement, usually three feet high, about four feet in diameter, and are open at the top. They are made with much care in order to bear the immense heat required in melting the sand and other materials of which the glass is made. Under ordinary care pots serve about two months and the furnace about two years, though neither should be allowed to cool. The melted material contained in the pots is dipped by workmen with an iron tube, called a *blowpipe,* this being turned over and over until a sufficient quantity gathers and assumes an oval form. After placing the melted glass in a proper mold, it is blown and formed into the desired shape, such as a bottle, vase, tumbler, or some other vessel, this depending on the mold used.

The *engraving* on glass is effected by means of a sand blast, while *glass cutting* is done by a process of grinding on a cast-iron wheel, with which water and sand is brought in contact. Cut glass is prized for its brilliancy and is used in making fine grades of table glass. The ornamentation is not put on until after the glass has been annealed, a process under which it is gradually cooled, and requires about 36 hours. *Sheet glass* is made by taking the melted material from the pot, when it is blown and whirled until it assumes a cylindrical form. The ends are then cut off, the cylinder is cut open longitudinally, and the sheet is heated, pressed and rubbed until it is flattened out. *Plate glass* is made by pouring the melted material upon a table, which has a marginal edge equal in height to that desired for the thickness of the glass. It is then flattened out by a roller passed over the table, resting on the edges, and thus secures equal thickness throughout. In making *stained glass,* the paint, which is usually compounded of the oxides of metals and oil of turpentine, is applied when cold and the colors are afterward stained into the glass by heating the latter. *Mosaic glass painting* is a department of art painting and is not to be associated with glass manufacture. The most common mosaic glass painting is executed with an enamel or a stain.

GLASS, Carter, public man, born at Lynchburg, Va., Jan 4, 1858. He became a printer and published the *Daily News.* In 1899 he was elected to the state senate and became a member of congress in 1902, serving until 1919, when he was appointed secretary of the treasury by President Wilson. He attained much success in 1918 when he had charge of the fifth war loan of the United States.

GLASTONBURY (glăs'tŭn-bĕr-ĭ), a town of Somersetshire, England, on the Brue River. In 1539 the supposed grave of King Arthur was discovered while excavating for the abbey and a church. The abbey is one of the oldest in England. Population, 1921, 4,185.

GLAUBER'S SALT (glou'bĕrz), the popular name of a salt found native in sea water and the water of many mineral springs and saline lakes. It was so named from J. R. Glauber (1604-1668), a German chemist, who first prepared it by decomposing sodium chloride with sulphuric acid. Glauber's salt has a bitter saline taste, is soluble in water, and becomes liquid when heated. It loses most of its water by crystallization and becomes a white powder when exposed to the air. The chief use of this product is as a purgative medicine, especially in veterinary practice. It is used in fixing lead mordants in dyeing and printing and in the production of certain kinds of glass.

GLAZING (glāz'ĭng), the art of imparting a smooth, shining surface to anything, such as

pottery, gunpowder, and paintings, to prevent them from being penetrated by fluids. The most common mixture for earthen vessels is constituted of ground flint with oxide of lead, which is generally used, but in various proportions and with different tints.

GLAZUNOFF (glä-zōō-nôf'), **Alexander,** composer, born in Saint Petersburg, Russia, in 1865. He studied at the Polytechnic Institute in Saint Petersburg, and later took training under several musical masters, among them Liszt at Weimer, Germany. In 1881 he finished his first symphony, which was accorded an enthusiastic reception, and in 1889 he visited Paris and London. In the latter city he conducted his fourth symphony at the London Philharmonic Society, and in 1897 he conducted at Saint Petersburg the national Russian symphony concerts. The Thomas orchestra at Chicago played many of his compositions, especially concert waltzes and smaller instrumental works, many of which are very popular in America. Being prolific and efficient as a composer, he is regarded a representative of the national school of Russia.

GLEIWITZ (glī'vĭts), a city of Germany, in the province of Silesia, 98 miles southeast of Breslau. It is on the Klodnitz River and the Klodnitz Canal, has steam and electric railways, and is regularly platted and well paved. The manufactures include paper, glass, hardware, cigars, clothing, and machinery. Gleiwitz is first mentioned in the 12th century, but its larger development dates since the last two decades. Population, 1920, 66,983.

GLENCOE (glĕn'kō), a celebrated valley of Scotland, in the County of Argyll, near Loch Etive. The sides are almost perpendicular, rising abruptly to heights of 3,000 feet above the valley and giving the locality a wild and sublime aspect. In 1692 it was the scene of the Massacre of Glencoe, when Mac Ian, chief of the Macdonalds of Glencoe, was destroyed by his enemies under the leadership of Sir John Dalrymple. It had been arranged that he and his followers should have pardon if they submitted to William III. and Mary before Dec. 31, 1691, but the delay in the surrender caused his enemies to take advantage of the technicalities and treacherously destroy about sixty men, women, and children. Though the morning was stormy, about 300 men and women escaped, but a number of them perished from cold and hunger.

GLENDOWER (glĕn'dōōr), **Owen,** famous Welsh chief, last native to assume the title of Prince of Wales, born in Montgomeryshire, in 1349; died Sept. 2, 1415. He was called to the English court, where he became a favorite of Richard II., and later was made esquire to Henry IV. Lord Gray seized some of his lands in the early part of the reign of Henry IV., and, failing to secure assistance from the king, Glendower took up arms to establish the independence of Wales. After conducting a war with more or less success, he succeeded in taking Lord Gray and Sir Edward Mortimer prisoners in 1402. Two years later he formed an alliance with Charles VI. of France against England and secured the assistance of a powerful French army. The war was carried on for many years and a pardon was offered him several times on condition that he would submit, but this he refused to do and continued to harass the English king until his death

GLENS FALLS, a village of Warren County, New York, on the Hudson River, 55 miles north of Troy. It is on the Delaware and Hudson Railroad. The noteworthy buildings include the Crandall Free Library, Glens Falls and Saint Mary's academies, the Parks Hospital, and several charity homes. Among the manufactures are machine shops, iron foundries, brick works, paper mills, and cigar, shirt, and furniture factories. It has electric street railways and lights, waterworks, and a sewerage system. The surrounding country contains valuable deposits of limestone and black marble. It was incorporated in 1837. Population, 1900, 12,613; in 1925, 17,851.

GLENVILLE (glĕn'vĭl), a village of Ohio, in Cuyahoga County, five miles from Cleveland, to which it was officially annexed in 1905. It is situated east of Gordon Park, on paved highways and the New York Central Railroad, and is a well-improved place. The manufactures consist chiefly of furniture and machinery. It was settled in 1804 and incorporated in 1872.

GLEYRE (glâr), **Marc Charles Gibriel,** noted painter, born in Chevilly, Switzerland, May 2, 1806; died May 5, 1874. His parents died when he was nine years of age, when he was placed under the care of an uncle at Lyons, and spent four years at Paris in the study of art. Later he resided in Rome, traveled extensively in Greece, Asia Minor, Egypt, and Nubia, and on returning to Europe opened a studio at Paris. In 1840 he exhibited his "Apocalyptic Vision of Saint John," by which he attracted favorable attention. In his paintings he exercised much care by being slow in execution and succeeded in giving an effect that always pleased. A number of his works won medals and, while exhibiting at the Retrospective Exhibition in behalf of exiles in Alsace and Lorraine, his death occurred suddenly. Among his productions are "The Young Nubian," "Separation of the Apostles," "Dance of Bacchantes," and "Earthly Paradise."

GLOBE, a sphere used in geography and astronomy for the study of terrestrial and celestial phenomena. A *terrestrial globe* is a common schoolroom apparatus and is a useful supply in the study of geography. A globe of this kind may be made of plaster, metal, or pasteboard, upon the surface of which is a map or a representation of the surface of the

earth. The extremities of an axis passing through the center represent the poles of the earth, and it is usually so constructed that it may be turned upon the axis to indicate the rotation of the earth. Meridians and parallels of latitude are indicated by lines drawn upon the surface. The meridians are usually drawn through every 15° of the Equator, hence each two indicates points that differ by one hour in time. The globe is suspended in a brass ring somewhat larger than the diameter, within which it turns upon the axis, and is usually mounted on a wooden stand. In size globes vary from those six inches to four feet in diameter, though much larger ones have been constructed. A *celestial globe* has represented upon its surface the stars, which are placed in positions to indicate their actual location.

GLOBE, county seat of Gila County, Arizona, 70 miles east of Phoenix, on the Arizona Eastern Railroad. It has extensive interests in copper mining and owes its recent growth to the development of that industry. The features include electric lighting, high school, public library and courthouse. Population, 1920, 7,044.

GLOMMEN (glŏm'mĕn), the most important river of Norway, rises in Lake Aursundsjö, and flows into the Skager Rack. Its source is in the province of South Trondhjem, near the town of Röros, and its course of 350 miles is in a general southwesterly direction.

GLOUCESTER (glŏs'tẽr), a river port and city of England, on the Severn River, about ninety miles northwest of London. Numerous railroads and canals facilitate important commercial enterprises, for which it is noted. Among the noteworthy buildings is the cathedral, one of the largest in England, being 140 feet wide and 420 feet long. The tower is 225 feet high. It contains the Great Peter's Bell, weighing more than three tons. Other buildings include the public library, a theological college, King's School, and an asylum for the insane. Among the manufactures are flour, cordage, cutlery, ships, ironware, and machinery. Gloucester was a Roman station under Aulus Plautius. At the time of the Saxons it was an important center of trade. Population, 1921, 50,029.

GLOUCESTER, a port of entry in Essex County, Massachusetts, thirty miles northeast of Boston. It is on the Boston and Maine Railroad, near Cape Ann, and includes Riverdale and several other villages. The municipal improvements include waterworks, electric and gas lights, stone and asphalt pavements, and electric street railways. It is distinctly a commercial city and its domestic fisheries are the most important in America. Those employed in mackerel and cod fishing include about 5,000 persons. It is the seat of a United States piscicultural station, is the center of a large foreign trade, and has a convenient harbor. The manufactures include clothing, machinery, mucilage, tents, seines, sails, canned fish, and granite products. In 1765 it had a population of 3,763, since which time it has grown steadily. Population, 1905, 26,006; in 1925, 23,375.

GLOUCESTER CITY, a railroad center of Camden County, New Jersey, on the Delaware River. It is on the West Jersey and Seashore and the Atlantic City railroads, one mile south of Camden, and is connected with Philadelphia by steam ferry. The chief industries are fishing and manufacturing. Among the manufactures are canned fish, calicoes, ginghams, and machinery. It was settled in 1677 and incorporated in 1868. Population, 1905, 8,055; in 1920, 12,162.

GLOVE (glŭv), a covering worn on the hand, having a separate sheath for each finger. Gloves are made of various materials, such as silk, wool, linen, cotton, fur, and different classes of leather. Several kinds of the finer gloves are manufactured of the real skins of goats, but most kid gloves are made of lambs' skins. The so-called dogskin, buckskin, and doeskin gloves are manufactured chiefly from sheepskin. In manufacturing this class of gloves the leather is dressed as light as possible and each glove is cut by means of a die. Much of the sewing is done by machinery. The glove is stretched over a metal hand, which is first heated on the inside, and the material is smoothed or dyed as desired. Gloves are cleaned with oil of turpentine, camphor, or benzine, the last mentioned being the cheapest and most serviceable substance now in use. Machine sewing is used largely in the cheaper grades, the best being hand-stitched. Gloversville, N. Y., contains large gloveworks, though factories are located in the larger cities throughout Canada and the United States. The finest and most expensive gloves produced in the world are made in France.

GLOVERSVILLE (glŭv'ẽrz-vĭl), a city of Fulton County, New York, on the Cayadutta River, fifty miles northwest of Albany. It is on the Fonda, Johnstown and Gloversville Railroad. The streets are mostly broad and well paved. It has sewerage, stone and macadam pavements, electric lights, and street railways. Among the noteworthy buildings are the high school, the Nathan Littauer Hospital, and a public library with 10,000 volumes. The manufactures include machinery, vehicles, cigars, gloves, and buckskin and other mittens. In the manufacture of gloves it takes very high rank among the cities of America. It was known as Stump City until 1832, when it received its present name, and was incorporated as a city in 1890. Population, 1905, 18,672; in 1925, 22,110.

GLOWWORM, a name applied to several species of serricorn beetles. They somewhat resemble a caterpillar and are remarkable for the luminosity of some of the segments of the abdomen. The male has wings and emits a very faint light when flying about at night, and is attracted to the female by her soft, but strong, light. The luminous matter is capable

of mixing with warm water, which increases its brilliancy. Though both sexes are luminous, the light in the female is much stronger than that of the male. The latter is wingless. See **Firefly.**

GLOXINIA (glŏks-ĭn'ĭ-à), a genus of herbaceous plants native to the tropical parts of America. It was so named from B. P. Gloxin, a German botanist, who developed a number of the species into fine flowering varieties. The

GLOXINIA.

common gloxinia has soft, velvety leaves and a nearly bell-shaped corolla. It flowers profusely. It is a favorite plant in flower gardens, both for the richly colored leaves and the graceful flowers.

GLUCK (glōōk), **Christoph Wilibald Ritter von,** musical composer, born in Bavaria, Germany, July 2, 1714; died in Vienna, Nov. 15, 1787. He secured early training in music at Prague, but later studied in Vienna, and in 1738 went to Italy to complete his musical education under Sammartini. His first opera, "Artaxerxes of Metastasio," appeared in 1741 and was acted at Milan. Later he produced numerous others, returned to Vienna and in 1745 was invited to London, where he met a prolific rival in Handel, who had gone there from Germany. Later he produced numerous operas at Vienna, Rome, and Naples. His style is noble and grand, and by consecutive and studious devotion he elicited the admiration of all Europe. Among his most noted productions are "The Fall of the Giants," "Orfeo," "Antigone," "Alceste," and "Iphigénie."

GLUCOSE (glū'kōs), a sugar found in the vegetable kingdom and in honey. It occurs in small quantities in various animal substances, as in the blood and liver. Another name for it is grape sugar or starch sugar. It is less sweet than cane sugar and is manufactured in considerable quantities both in solid and liquid forms. A report made in 1840 by a committee of the National Academy of Science to the commissioner of internal revenue placed the sweetening power of ordinary glucose at about two-thirds that of cane sugar. The manufacture in the United States is principally from corn and in Europe it is made chiefly from potatoes. Its use is mostly for table syrups and confectionery, though it is employed in making artificial honey, in brewing beer and ale, and as a food for bees. In the production of artificial honey, the comb is made of paraffin and the cells are filled by machinery with a pure grade of glucose. Though less sweet than real honey, it is inviting, has a fine appearance, and can be sold at about one-half the price of genuine honey. As bleached grape sugar it is often mixed with table sugar and is used largely in the manufacture of condensed milk. A bushel of corn yields from 30 to 45 pounds of glucose. Manufacturers recognize four substances in corn, all of which are useful, but they need to be separated in order to secure the product desired. They comprise starch, oil, gluten, and bran.

The first process in manufacturing glucose is to soak the corn in water, in large wooden tanks, which hold from 500 to 1,000 bushels of corn. A temperature of 80° Fahr. is necessary, and fumes of burning sulphur are injected for the purpose of dissolving the gummy properties that bind together the gluten and starch. After soaking from one to three days, the corn is washed with fresh water and ground between corrugated rollers and crushed. Next the crushed material is placed in tubs and stirred mechanically with the view of separating the germs from the other portions. This is done for the purpose of afterward extracting the oil in the germs, which is about 50 per cent., and is valuable as a salad oil, for mixing paints, and in making toilet soaps. The oil is extracted from the germs by means of powerful hydraulic pressure of about 4,000 pounds, which causes it to run in a stream into tanks below, and the residue is utilized as a food for cattle. Next the gluten is removed from the starchy matter by means of a filter press, and is then dried and sold at about $18 per ton for cattle food.

After practically all the ingredients unnecessary in the manufacture of glucose have been removed from the starchy material, the residue is mixed with water, and, by a process of filtering several times under the influence of sulphuric and muriatic acid, it is converted into a syrup. The converting is done most effectually under a pressure of from 25 to 40 pounds, the starch being heated by means of steam, about an hour being necessary to complete the process of converting starch to glucose or grape sugar. The product at this stage contains about 35 per

cent. of solid matter and is of a yellowish-brown color. To clarify it the liquid is passed through animal charcoal, by which all foreign substances and the coloring matter are removed, though for the higher grades a second filtration is necessary. After this process, the liquid is evaporated in a vacuum until it has reached the desired consistency for syrup or takes on the form of sugar.

The manufacture of glucose from beets differs somewhat from the process employed in using corn, though the steps employed in the later stages are similar. The amount of corn consumed yearly in the manufacture of glucose in the United States is about 48,000,000 bushels, though the quantity varies somewhat with the price of corn and sugar, many factories limiting the output when corn is high in price and sugar is cheap, and increasing the capacity when the reverse is true. Within recent years glucose manufactured from beets has been encouraged under government supervision and has attained to the rank of an important industry. See **Sugar.**

GLUE, a viscid cement or adhesive preparation, usually a form of impure gelatin derived from boiling certain animal substances. Glue is used for uniting pieces of wood and other materials. It is made largely of the offal and heads of fish in seacoast towns, and from remnants of slaughterhouses, such as the feet, heads, cartilage, and sinews of hogs, cattle, and sheep. In some places it is made in large quantities from the fleshings, ears, horn piths, and intestines. These portions are freed from dirt and hair by boiling before they are actually utilized in the manufacture. The product is sold in the market either as thin, hard, or brittle cakes, which are afterward dissolved for use, or in a liquid form ready to be applied. *Gelatin* is made much the same as glue, but the parts used are selected with a view of making that product and are cleaned with greater care. *Fish glue* is made of isinglass dissolved in water. Commercial *isinglass glue* is manufactured of isinglass soaked in cold water, which, when swelled, is put in spirit of wine and later powdered chalk is added. *Marine glue* is made of equal parts of caoutchouc and shellac dissolved separately in naphtha and then mixed. *Waterproof glue* is derived from isinglass, for which purpose it is boiled in skim milk until the required consistency is obtained. *Fish glue* is used largely in making fine confectionery and as a gum for sealing letters.

GLUTEN (glū'tĕn), or **Vegetable Fibrine,** an elastic albuminous substance of a grayish-yellow color, obtained from the flour of wheat and other cereals. The flour of good wheat contains about twenty per cent. of gluten. When gluten is heated, it crackles and swells, and when dried it loses more than one-half of its weight. It gives tenacity to the paste of flour and is important for its nutritive quality. Careful analyses have proven that the bran of wheat contains a larger per cent. of gluten than is found in the flour and, consequently, is more nutritious than the finely bolted flour. Since gluten gives tenacity to the dough, it is possible to judge of the quality of flour by test. The juices of certain plants, as well as oats, rye, barley, and other grains, contain gluten.

GLUTTON (glŭt't'n), a carnivorous mammal of the badger family, ranging intermediately between the weasel and bear. It is found in the northern part of Eurasia and North America, extending as far south in the United States as Great Salt Lake. The common name applied generally is *wolverine.* Its fur is a valuable article of commerce, being used for muffs and sleigh robes.

GLYCERIN (glĭs'ĕr-ĭn), an oily, transparent liquid compound, nearly colorless, with a sweetish taste. The different varieties are obtained by the decomposition of animal fats and some vegetable substances under treatment with alkalies, or superheated steam. It was first discovered by Scheele in 1779 while saponifying lard with the oxide of lead. Glycerin serves many useful purposes in the arts. It is of value as a preparation to keep more or less moist substances useful in the arts, such as paper for printing, tobacco, modeling clay, and materials used in rope making, spinning, weaving, and tanning. Glycerin is employed to lower the freezing point of water and as a preservative of meat and natural history specimens, and is the basic substance for many chemical products, among which nitroglycerin is one of importance. It is insoluble in ether, absorbs moisture from the air, and may be dissolved by a mixture composed of alcohol and water. In the manufacture of soap it serves a useful purpose in that it has the tendency to soften the skin, and as a medicine it is employed largely as a soothing and healing substance. Manufacturers of confectionery employ it. In some instances it is used as an adulterant of beer, wine, and milk, and is itself adulterated with cane sugar and glucose.

GLYPTODON (glĭp'tō-dŏn), a large extinct mammal, a member of the armadillo family, formerly common to the southern part of North America and the northern part of South America. Fossil remains are found in many parts of Florida, Texas, Mexico, and as far south as Argentina. Four species have been described. The back and sides of the animal were covered with bony plates and the tail was encased in a sheath of horny scales. It resembled the Galapagos tortoise rather than the armadillo, but its size was much larger, since the fully developed specimens measured from six to eight feet in length.

GNAT (năt), a genus of insects found in marshy places, having wings laid flat on the back when at rest. The mouth of the female is furnished with a long, projecting proboscis

adapted for piercing the skins of animals and sucking the blood, while the male has a proboscis with featherlike projections more suitable for sucking honey from plants. The eggs of the gnat are laid on the surface of stagnant water, hatching in about three days, and the young live in the water until they are fully grown. Several generations of gnats hatch in a single summer. The common mosquito belongs to this genus of insects.

GNEISENAU (g'nī'zę-nou), **August Wilhelm Anton von,** field marshal, born at Schildau, Germany, Oct. 27, 1760; died Aug. 24, 1831. He studied at the University of Erfurt and subsequently entered the military service of Austria. In 1782 he came to America with a force of British to aid England in the Revolution, but returned the following year to enter the service of Prussia against Poland. He took part in the battles of Jena and Saalfeld against Napoleon in 1806, and was raised to the rank of major for valuable service. In 1813 he conducted the retreat after the Battle of Lützen, fought in France the following year, and contributed by his strategic skill to the final success at Waterloo. He became governor of Berlin in 1818. Subsequently he was made field marshal and commanded a German army during the Polish insurrection of 1831, but died before the disturbances were suppressed.

GNEISS (nīs), a term introduced from the German to designate a variety of metamorphic rocks composed of mica, feldspar, and quartz. Gneiss differs from granite in that the constituents are arranged in layers instead of forming a confused aggregate mass. Originally it was sand or mud, having been acted on by heat in the course of time, and was converted into a hard, tough crystalline rock. It contains no fossil remains, since they were destroyed by the action of heat, but it is rich in copper, iron, cobalt, gold, silver, and other metallic ores. Large deposits are found in Northern Europe, especially in Norway, and in the Alpine region of that continent. New Brunswick, New England, and New York have large deposits of gneiss.

GNOSTICISM (nŏs'tĭ-sĭz'm), a system of philosophy devised to solve the origin of evil, and which flourished extensively from the 1st to the 6th centuries. It occupied a middle ground between Christianity and paganism, holding that knowledge rather than faith is the key to salvation. It promulgated the doctrine that there is an eternal God of infinite power, wisdom, and goodness. While there were many systems of gnosticism, all Gnostics agreed that God is incomprehensible, that all the natural and spiritual existences are derived from emanations from the supreme Deity, and that Christ was a superior emanation.

The two main branches of the Gnostics were generally distinguished as the Jewish and the Greek. Many sects of Jewish origin sprang up, including mainly the Sethians, the Cainites, and the Ophites, the last named being serpent worshipers. Meander and Cerinthus were the leading Jewish Gnostics. The Greek Gnostics belonged chiefly to the schools of gnosticism founded by Basilides, Valentinus, Heracleon, and Ptolemy. Basilides and Valentinus were the founders of the Alexandrian Gnostics, which constituted the most important branch of the Gentile Gnostics. The literature of the Gnostics is extensive, but the sects did not endure beyond the 5th century.

GNU (nū), a kind of antelope found in small herds in South Africa, belonging to the ruminating animals. The hair is black, or yellowish,

GNU.

and bristly, the mane is white and stiff, and the tail resembles that of a horse. The average length of the body is nine feet. In all species the female is somewhat smaller than the male, but both have horns and cloven feet, and move with a gallop like a horse. When caught young, they can be domesticated. The flesh is considered a nutritious article of food.

GOAT, a hollow-horned ruminant quadruped which is allied to the sheep. It differs from the latter in having erect or keeled horns, an arched forehead, a short tail, and a bearded chin. The male is characterized by an unpleasant odor. Goats are common to mountain regions. They are skilled in passing over precipitous and rocky ledges, springing with much precision from rock to rock, and subsist on coarse and scanty food. It is thought that the domestic goat descended from the wild species of Western Asia, since they resemble those largely in size, form, and habits. Many species are known in both the wild and the domestic states, but they are commonly subdivided into goats proper and ibexes. Some are valuable for their production of wool or hair, flesh and milk. Many species are reared extensively in Eurasia for their flesh, which resembles mutton, and for general dairying purposes. The skin yields leather known as morocco, which is valuable in the manufacture of gloves and shoes. The intelligence of goats is proverbial, many species being known for their playfulness, ingenious

habits, skill in seeking protection, and contriving cuteness in obtaining food. Innumerable species have been domesticated in all inhabitable portions of the world. The food consists principally of grass and herbs, though they partake of many forms of vegetation and are fond of

HIMALAYAN GOAT. ROCKY MOUNTAIN GOAT.

the younger shoots and bark of many shrubs and trees. The *Angora goat* (q. v.) has silky hair eight or nine inches long which hangs in curly locks from its sides. It is of a silver white color and useful in the arts and manufactures. The *Cashmere goat* (q. v.), a native of Cashmere, is rather undersized and has fine silky hair. Other species, including the *Maltese* and *Nubian* goats, are known for their superior milk, skin, and flesh. The *Rocky Mountain goat* is a native of the western portion of Canada and the United States, where it is generally known as the goat antelope.

GOAT ISLAND, an island in the Niagara River, at Niagara Falls. It divides the current where it plunges over the precipice, being situated between the American Falls and the Canadian Falls. The island is reached from the city of Niagara Falls, N. Y., by a fine stone bridge. It is covered with beautiful evergreen and deciduous trees and is improved by walks and drives. A fine view of the falls is obtained from the west end of the island.

GOATSUCKER (gōt'sŭk-ēr), the common name of the European nightjar, which is allied to the night hawk, whip-poor-will, and other birds of North America. The goatsucker is so named from the popular belief that it sucks the milk of goats and cows and in so doing infects these animals with a deadly disease. The name nightjar comes from a jarring or purring sound which it utters. Birds of this class have large mouths and at dusk frequent the ground in search of insects, from both of which facts the erroneous belief that they suck animals likely arose.

GOBI (gō'bē), **Desert of,** a vast stretch of desert in Central Asia, called Shamo, or Sand-Sea, by the Chinese. It is included in China, Turkestan, and Mongolia. The length is about 1,750 miles; breadth, 375 miles; and area, 290,850 square miles. Spurs of the Altai, Tian Shan, and Yablonoi mountains traverse the northeastern part. The general elevation above sea level is 4,000 feet. The boundary is designated by a gradual rise in a series of marked terraces and several interior rivers. The central point is at Ozon Khoshu, which is the lowest region in Central Asia, and is elevated about 1,940 feet above the sea. The interior is thought to have formed a vast sea in former times, but now is occupied by different Mongolian tribes, who utilize the region in rearing sheep, horses, cattle, and camels.

GOD, or Supreme Being, the infinite, eternal, immutable Creator and Preserver of all things, and the object of human sacrifice and worship. In Christian theology there is a general agreement that God is a perfectly good, true, and righteous personal spirit, that he is eternal, and that he possesses omnipotence, omnipresence, and omniscience. Christians generally agree as to the trinity of God; that is, he is held to be one individual, but constituted of three persons—God the Father, God the Son, and God the Holy Ghost. The three are held to have existed from eternity, not as three distinct beings, but as one God, the glory equal and the majesty coeternal. In the doctrine of the trinity, which is most elaborately defined in the Athanasian Creed, the persons of the Godhead are not to be confounded nor is the substance to be divided. God the Son is worshiped as Jesus (q. v.), who came to the earth, born of God and the Virgin Mary, to redeem fallen man under a plan of salvation instituted by the merciful God for his creatures. The Holy Ghost, the third person of the trinity, the Father being the first and the Son the second, is held to proceed from the Father and the Son, though is equal to them in substance and majesty. His function as a spirit of holiness is to apply to the hearts of men the benefits of Christ's death, and to sanctify them by inducing a belief in the truth as it is in Jesus. The Jewish people generally hold to the belief in Jehovah (q. v.), but reject Christ as the redeemer, and believe that the Saviour is yet to come.

Practically all peoples, even the most savage, manifest belief in a being higher than man. There seems to be an innate feeling, a potent something, in man that renders him a worshiping being and leads him to stand in awe when contemplating the greatness and wisdom of the Creator and Preserver of the universe as a whole, and of the immutable laws under which organic and inorganic substances either multiply their kind or endure without material change. Within man dwells either a living faith in the superiority of his power to nature, which induces a feeling, an experience, that grounds his belief in God, or he denies his superiority to nature and is without faith in God, in which aspect he experiences nothing in existence but necessity and fate. Hence, the argument for the existence of God is based upon certain fun-

damental principles involved in our mental and moral being, such as causation and design. The existence of God is likewise argued from the manifestations he has made to man, either by miracles, visions, or personal contact, but even Christian theists admit that they cannot be accepted as real unless faith in the divine existence was previously held by those receiving them.

Various terms are employed to designate belief or disbelief in God. *Theism* is a system of belief in God as the Creator and Preserver; *atheism* implies, not a denial of the existence of a Deity, but an absence of any definite idea on the subject; *polytheism* is the doctrine that there are more gods than one; and *agnosticism* is the belief that God is unknown or unknowable. *Monism* is the doctrine which attempts to explain the cosmos by one principle of being or ultimate substance and may be materialistic, idealistic, or pantheistic. *Materialistic monism* holds that all spiritual phenomena are from matter; *idealistic monism,* that both spiritual and material phenomena are from spirit; and *pantheistic monism,* that both mind and matter are from one original substance, neither being substantial. *Materialism* is a denial of the doctrine that man possesses any immaterial part. *Fetichism* is a form of worship which implies the ability of man to force the Deity to comply with his wishes, and *totemism* is a kind of nature worship in which stones, trees, rivers, etc., are adored.

GODARD (gō-där′), **Benjamin Louis,** composer, born in Paris, France, Aug. 18, 1849; died Jan. 12, 1895. He studied music at the Paris Conservatory, where he developed remarkable skill on the violin under the influence of Reber. Later he gave attention to compositions, producing many that have been highly praised. His work entitled "Tasso" won the prize at a musical competition of Paris in 1876 and takes rank as his most noted composition. In the same year he adapted a number of the works of Schumann to the orchestra. His productions include "Ruy Blas," "Pedro de Zalaméa," "Les Guelfes," and "Les Elephants."

GODAVARI (gō-dä′vȧr-ē), a river of central India, the largest stream of the Deccan. It has its source near the Indian Ocean and, after a course of 900 miles, enters the Bay of Bengal by a delta of seven mouths. The entire basin drained includes an area of 112,000 square miles, a large portion of which is fertile. Along its banks is much beautiful natural scenery. At various places the water is led by canals from the narrow channel and utilized for irrigating purposes. The river is held sacred by the Hindus, and is the objective point of numerous pilgrimages. Among the chief tributaries are the Purna, the Maner, and the Manjera.

GODFREY OF BOUILLON (gŏd-frwä′ bōō-yŏn′), Christian knight and leader of the first Crusade, son of Eustace II., born in Baisy, Belgian Brabant, about 1061; died July 18, 1100. He first attained distinction in the German campaigns under Henry IV. in Germany and Italy, was made Duke of Bouillon, and later was elected the leader in the first Crusade. In 1095 he conducted an army of 80,000 men by way of Constantinople, defeated the Egyptians at Ascalon, and soon became master of all Palestine. Subsequent to the capture of Jerusalem he was elected king, and strengthened himself with his chief supporters by establishing a system of feudal laws. Tasso made him the leading character in "Jerusalem Delivered." Many poems of the Middle Ages contain allusions to him.

GODIVA (gŏ-dī′vȧ), **Lady.** See **Coventry.**

GODKIN (gŏd′kĭn), **Edward Lawrence,** journalist, born in Moyne, Ireland, Oct. 2, 1831; died May 20, 1902. In 1851 he graduated at Queen's College, Belfast. He is the author of a number of books, among them "History of Hungary, A. D. 300-1850," "Problems of Municipal Government," "Reflections and Comments," and "Problems of Modern Democracy."

GOLDMAN, Emma, labor agitator, born in Kovno, Russia, June 27, 1869. She was taken to Courtland and later to Königsberg, Germany, where she studied, and subsequently lived in St. Petersburg. In 1886 she came to New York, where she worked at low wages in a clothing factory, and was converted to the ideas of anarchism. Her ability to use several languages made her a potent factor among anarchists, both in America and Europe, and she was imprisoned many times for speaking against government and in favor of *direct action.* In 1917 she was convicted for interfering with the draft law and sentenced to two years' imprisonment and later banishment from the United States. She lectured extensively and published "Anarchism," "Marriage and Love," and "Patriotism a Menace to Liberty."

GOD SAVE THE KING, the national song of Great Britain. The words were probably written by Henry Carey (1696-1743) and the music was adapted from the national air of Germany, entitled "Heil Dir Mein Vaterland." The popular patriotic song of the United States, "My Country, 'Tis of Thee," is sung to the same tune. In Great Britain the song, "God Save the King," is played and sung on festive occasions.

GODWIN (gŏd′wĭn), Earl of Wessex, born in the latter part of the 10th century; died April 7, 1053. At first a cowherd, he rose to the rank of nobleman. Subsequently he took a prominent part in advocating Edward the Confessor for the throne in 1042, and shortly after the latter married his daughter, Editha. Owing to the dislike of Edward for the Normans, the marriage proved an unhappy one and was the means of causing a quarrel between Godwin and the king, and the former was banished. However, Godwin landed with an army in 1052 and forced the king to restore to office his family and others of Norman descent.

GODWIN, Parke, author and journalist, born in Paterson, N. J., Feb. 25, 1816; died Jan. 7, 1904. He graduated at Princeton in 1834, was admitted to the bar, and practiced law for a short time in Kentucky. However, he soon removed to New York City to assume the editorship of the New York *Evening Post,* which had long been edited by William Cullen Bryant, whose daughter he married. He contributed to several magazines and other periodicals and translated many works of the German authors. His writings include "A Handbook of Universal Biography," "Democracy, Civic and Constructive," and "A Mythological Tale."

GOEBEL (gē'bĕl), **William,** public man, born in Sullivan County, Pennsylvania, in 1856. He removed to Kentucky when a boy, where he began the study of law in 1873, and entered upon a successful practice at Covington. His professional reputation is based largely upon his ability as a trial lawyer, and he became prominent as a leader in politics. In 1887 he was chosen State Senator and served successively until 1898, and the following year was elected as a Democrat to the office of Governor. The campaign resulted in a bitter fight and it was claimed that W. S. Taylor, the Republican nominee, was elected by a plurality of 3,200 votes. The election was contested and a legislative committee had agreed to report in favor of Goebel, but he was shot on Jan. 30, 1900, from the effects of which he died Feb. 3, 1901.

GOESSMANN (gĕs'mân), **Charles Arthur,** chemist, born in Naumburg, Germany, June 13, 1827; died Sept. 1, 1910. He studied at Göttingen, where he was assistant in the chemical laboratory, and in 1857 came to the United States. To extend his knowledge of sugar manufacture, he traveled in Cuba and other regions where sugar is produced. He published many valuable reports and works, among them "Salt Deposits of Petite Anse, La," and "Best Mode of Manufacturing Coarse or Solar Salt from the Brines of Onondago."

GOETHALS, George W., public man, born at Brooklyn, N. Y., June 29, 1858; died Jan. 21, 1928. He graduated at West Point and engaged in engineering for the government. In 1907 he was made chief engineer and chairman of the Panama Canal Commission, serving until 1914, when President Wilson appointed him governor of the Panama Canal Zone. In 1917 he was made manager of the ship construction department, but resigned on account of disputes with William Denman, the chairman. During the World War he rendered distinguished services on the U. S. Shipping Board.

GOETHE (gē'tę), **Johann Wolfgang von,** celebrated author, born in Frankfort-on-the-Main, Germany, Aug. 28, 1749; died March 22, 1832. His father, Johann Kaspar Goethe, attained to the position of imperial councilor, being a man of affairs and a patron of learning, and held a doctorate of law. His mother, Katharina Elisabeth Goethe, was a woman of exceptional intellect and was made the heroine of Bettina von Arnim's "This Book Belongs to the King." Young Goethe secured his early education in his native city, but in 1765 entered the University of Leipzig, where he pursued a definite course of study and in the meantime gave much attention to music, art, and the drama. In 1770 he studied law at the University of Strassburg, in accordance with the desire of his father, but continued the study of his favorite literary work, and after receiving a degree returned to Frankfort. Shortly after he settled at Wetzlar to practice law, but did not find that profession congenial. In the love he bore a betrothed lady and the fate of a youth named Jerusalem he found a prolific subject for his work that marks an epoch in German literature, entitled "The Sorrows of Werther." About the same time he published the "Wanderer," "Wanderer's Storm Songs," and several others, which induced a wide interest. He published "Prometheus" in 1773 and the following year wrote "Clavigo" and "Edwin and Elmire."

JOHANN VON GOETHE.

In 1775 Charles Augustus, Duke of Saxe-Weimar, pressed Goethe to settle in Weimar, which he did in November of that year. The following year he was appointed privy councilor of legation and was given a seat and vote in the privy council. Serving for ten years as a public officer and producing numerous works of literary value, he earned a long-desired journey to Italy, and during his two years' residence there visited the principal Italian cities and Sicily. Within this time he revised a number of his former productions, completed "Egmont" and "Iphigenia," and began work on his master work, "Faust," the first part of which he published in 1808. He likewise turned his attention to the study of botany and optics. In 1790 his botanical work appeared, being devoted to a general discussion of the parts of plants and seed production. His collected writings in optics, entitled "Contributions to Optics," appeared soon after, and about the same time he served as director of the Weimar court theater.

Goethe accompanied the Duke of Saxe-Weimar on his campaign with a Prussian army against the French, witnessing the Battle of Valmy in September, 1792. Soon after his dramatic work first appeared at the Weimar theater, for which he also adapted several productions of Schiller and many of the best selec-

tions from other German authors. "Wilhelm Meister's Apprenticeship" was published in 1796. It received a general reading by the people of various countries, being translated into many languages. In 1821 the continuation of this novel was presented at the Wilhelm Meister theater as "Journeyman," which immediately elicited general interest. His famous poetic work, "Hermann and Dorothea," appeared in 1807, and it, like "Tasso," bears the type of the ripe manhood of the author, dealing with characters taken from humble life. The second edition of "Faust" had appeared sometime previously, presenting the several characters in an enlightened form. His work entitled "The Theory of Color," a treatise of scientific interest, was published in 1810, but it did not receive general approval among scholars. His "Autobiography" was published in 1814, and embodies many interesting literary and personal recollections. The second part of "Faust" was published in 1831, comprising a production generally classed among the greatest literary masterpieces of the world. Goethe's "Faust" has been credited by scholars as of equal rank with "Job" and "Hamlet," the three being regarded the finest tragedies extant.

Personally Goethe was a man of excellent appearance and a writer of deep soul and thought. He was imbued with a profound poetic spirit. His productions not only quickened the thought and feeling of Germanic peoples, but are widely read in the various languages into which they have been translated. While Schiller is a greater favorite with English readers, Goethe is essentially German and occupies a position in German literature quite similar to that retained by Shakespeare among the English writers. The literature that has gathered around him is sufficient to fill a library. Several fine monuments have been erected to his memory. His body lies with that of Schiller in the ducal mausoleum of Wiemar.

GOETSCHIUS (gĕt'shĭ-ŭs), **Percy,** composer and author, born at Paterson, N. J., Aug. 30, 1853. After studying music in his native State, he took a thorough course at the Stuttgart Conservatory of Music, Germany, where he graduated, and in 1885 was made royal professor in England. In 1890 he was elected professor of music and musical history at the Syracuse University, New York, and later had charge of musical composition in the New England Conservatory. He was organist of the First Parish Church of Brookline, Mass., a number of years and is the author of many anthems and sacred songs. In 1889 he completed a revision of the pianoforte works of Mendelssohn for the Cotta edition. His published works include "Theory and Practice of Tone Relations," "Material Used in Musical Composition," "Syllabus of Musical History," and "Homophonic Forms of Musical Composition."

GOG AND MAGOG, two names mentioned several times in the Scriptures. In Genesis Magog is alluded to as a son of Japhet. Ezekiel speaks of Gog as Prince of Magog, who formed an alliance against Israel. Some writers regard the Persians as descendants from Magog and assert that the Goths descended from both Gog and Magog. The same names were applied to two giants of early English history, of whom two statues are in the Guildhall at London.

GOGOL (gô'gôl-y'), **Nikolai Vassilyevitch,** author, born in the government of Poltava, Russia, Mar. 31, 1809; died Mar. 3, 1852. He studied at the Gymnasium of Niejin, where he began to write under the pseudonym of V. Alof. In 1828 he went to Saint Petersburg as a clerk in a government department. Later he held professorships of literature and history in the capital city, but soon devoted his attention entirely to literary work. He published a comedy entitled "The Government Inspector," in which he treated many official practices of Russia in a humorous vein and showed the alternate arrogance and servility of men in office. In 1848 he traveled in Asia Minor, visiting Jerusalem and other points of interest, and on returning to Russia took up his residence at Moscow. His writings include "Dead Souls," "Confession," "Evenings on a Farm Near Dikanka," "Cossack Tales," "Hans Kuchel Garten," and "Correspondence with Friends."

GOKSCHA (gôk-chá'), or **Sevanga,** a lake of Russia, in the government of Erivan. It is situated almost due west of Baku, between the Black and Caspian seas, and is surrounded by high mountains. The surface is 6,350 feet above the sea and covers an area of 540 square miles. The Sanga carries the overflow to the Aras River, which discharges into the Caspian Sea. An Armenian monastery is located on Sevang, an island near the northwestern part of the lake.

GOLCONDA (gŏl-kŏn'dâ), a ruined city and fortress of India, seven miles west of Hyderabad. Golconda was the capital of the principal kingdom of the Deccan, but was conquered by Aurungzebe in 1687. The fortress now serves as a military post and treasury of Nizam. It has extensive interests in cutting and polishing diamonds, which is the chief employment in the city, diamonds being mined some distance from it, at Partial, on the southeastern boundary of Nizam.

GOLD, a bright yellow precious metal, noted for its value, ductility, and malleability. The specific gravity is nineteen; the atomic weight, 196.7; and the melting point, about 2,282° Fahr. It has a ductility so great that a grain can be drawn into a wire 500 feet long and the same quantity is sufficient to gild two miles of silver wire. The malleability of gold makes it possible for one grain to be beaten out so as to cover 56 square inches, when it has a thickness of only $\frac{1}{282,000}$ part of an inch. Water and oxygen do

not act upon it at any temperature. Air does not tarnish it, and it may not be dissolved by hydrochloric, nitric, or sulphuric acid, but it is soluble in a mixture of nitric and hydrochloric acids. Gold crystallizes in cubes and other regular forms and yields two series of salts, aurous and auric. It is extracted from the quartz ore by pulverizing, and, after adding a quantity of mercury with some sodium, the amalgam is heated to liberate the mercury. In this process, which is called *cupellation,* the sulphur and arsenic are set free by highly heating the auriferous pyrites before treating them with the amalgam.

Pure gold is 24 carats fine, but it is used in the arts to form an alloy for the reason that pure gold is too soft to serve useful purposes. One-fourth of copper and three-fourths of gold form the usual alloy used by jewelers. In gold coinage two parts of copper and 22 parts of gold form the standard, making it 22 carats fine. The highest degree of fineness commonly used by jewelers is eighteen parts of gold to six of alloy; thus the degree of fineness is eighteen carats. Both gold and silver occur as an alloy in nature, this form of the metal being of a paler yellow than pure gold, while the copper alloy has a more reddish-yellow color. Gold serves a useful purpose in medicine, especially in scrofulous diseases, while dentists use gold leaf in filling teeth.

Gold has been sought from early historic times. The Bible makes mention of this metal in the second chapter of Genesis. It is found in alluvial deposits, occuring in small particles or nuggets, and is separated by washing in troughs and pans, by which the foreign matter is separated from the gold dust, grains, or nuggets. However, it occurs most numerously in sandstone, slate, quartzite, granite, and serpentine. The most celebrated gold fields are in Australia. Those of California, discovered in 1848, in El Dorado County, brought on the so-called gold fever of 1849. Gold found in Alaska occurs largely as placer deposits, while in many of the extensive mountain regions, as in Colorado, portions of the Pacific coast, and in South Africa, it is found in fissures or in quartz veins. The mining is done by vast machinery in the larger mines and the rock is crushed, after which the gold is separated from the rock and other ore bodies by excessive heat; natural gas, coal, and electricity are employed as agents in smelting.

Gold deposits have been found in more or less paying quantities in many of the states and in all the countries of the world, though in some regions the deposits are not sufficiently rich to warrant the application of time and labor. It is estimated that the value of the world's production of gold from 1493 to 1925 equaled $17,298,890,300. The present annual production of the world is estimated at $389,772,000, which was the total output for 1925. Of this amount North America produced $98,565,000; South America, $15,543,000; Europe, $14,088,000; Asia, $24,575,000; Africa, $219,914,000; and Australasia, $17,087,000. The largest pure gold nugget ever found was taken from the diggings at Ballarat, Australia, shortly after the discovery of the Australian gold fields in 1857. It weighed 130 pounds. California, Colorado, and South Dakota produced the largest output of gold in 1922, in the order named. Other very important gold fields are found in Alaska, Montana, British Columbia, Yukon, Saskatchewan, Utah, Arizona, Nevada, and Idaho. In 1925 Canada produced gold valued at $31,023,932 and the output of the United States was $52,101,400.

GOLD COAST, a British colony of West Africa, lying along the Gulf of Guinea. It has a coast line of 345 miles and extends inland 300 miles. The area is 16,500 square miles, but a protectorate of 46,600 square miles belongs to the colony. Among the principal towns are Accra, Elmina, and Cape Coast Castle. The first British colony within the region was founded in 1821. In the meantime several settlements were made by the Dutch, but they ceded their holdings to the British for trading privileges in 1872, since which time the English have had supreme control. Among the chief productions are live stock, gold, coffee, palm oil, copal, rubber, timber, monkey skins, and cocoa. Several railway lines connect the coast towns with the interior, while numerous canals and highways facilitate trade. The climate is quite unhealthful for Europeans. In 1923 the population was placed at 2,487,634, including about 500 Europeans.

GOLDEN AGE, the term applied in mythical history to the early period of many nations. It refers to a time when all animals were supposed to be at peace with each other, the earth produced the fullness of all necessary fruits for comfort, and innocence and happiness were general among mankind. The Egyptians believed that the gods sent successive conflagrations and deluges to purify the earth of guilt, and after these man was pure for a time, but when he was again degenerated a catastrophe once more came for his destruction. Roman literature was in its golden age from 150 B. C. to 14 A. D., when flourished the great Cicero, Caesar, Sallust, Ovid, Virgil, and Horace. In English literature the golden age includes the reign of Queen Anne, which period was made famous by the writings of such men as Pope, Addison, and Dryden.

GOLDEN BULL. See Bull.

GOLDEN FLEECE, in mythical history, a fleece taken by Phryxus from the ram Chrysomallus and nailed by Aetes in the Grove of Ares, where it was guarded at the entrance of the grove by an immense dragon which never slept. To secure the fleece Jason made his Argonautic expedition to Colchis, and, while Medea put the dragon to sleep, he carried the

treasure away. The name was applied to an order of knighthood, founded in Austria and Spain by Philip III. in 1429, which still survives and continues to be the highest order bestowed in those countries.

GOLDEN GATE, a passage from the Pacific to the Bay of San Francisco, about one mile wide. It separates two peninsulas and is defended by two forts, one on the inner and one on the outer side. The channel was named the Golden Gate by Sir Francis Drake in 1578.

GOLDEN HOUSE, a structure erected in Rome by Nero, located between Palatine and Esquiline hills. It covers an area of a square mile, including the baths, vineyards, and colonnades. In the court was a bronze statue of Nero, 120 feet high, and the portico was 3,000 feet long. The Golden House was taken down about 75 A. D., and the remains were used for the baths of Titus and Trajan. Though substantially constructed, only a few remains of the palace are now extant.

GOLDEN-ROD, a genus of plants allied to the aster, including more than one hundred species, most of which are native to America. The stems are rodlike, the leaves are alternate, and the flowers are closely bunched and yellow in color. In some communities the leaves are used for tea. The general distribution of the golden-rod has caused some states to adopt it as a state flower. It was selected as the national flower of the United States in 1899 by a vote taken among interested people.

GOLDFINCH (gōld'fĭnch), the name of several birds which are noted for their beautifully variegated colors, mostly yellow, red, black, and white. The bill is sharp and the song is exceptionally pleasing. A number of species are widely distributed, some being favorites as cage birds. They lay four or five purple and brown spotted eggs in nests built of twigs and moss, inlaid with wool, and most frequently breed in hedges and orchards. The goldfinch is found largely in America, Eurasia, and other grand divisions. A familiar species, the American goldfinch, or yellowbird, is found in most parts of North America.

GOLDFISH, a beautiful species of carp largely distributed in the fresh waters of China and Japan, whence it was introduced into Europe in the 17th century. In the native state it is greenish-brown in color, but by artificial breeding and selection a golden-yellow hue has been acquired. At present the goldfish is cultivated extensively, being kept largely in aquariums for ornament. When propagated in large bodies of water, the artificially bred revert to the color of the original stock. The silver fish is a species of the same class of fishes.

GOLD LACE, a kind of fabric made by weaving gilded silk threads, but so constructed that the product is quite flexible. The manufacture of this product requires an unusual degree of skill, since it involves the work of making sheets of gold much thinner than can be obtained by beating. The usual method is to burnish leaves of gold upon a rod of silver, which is then drawn into a very fine wire, after which it is further extended by flattening between polished steel rollers, and the finishing is done by passing it through perforated diamonds or other gems. By this process it is possible to make a film much thinner than beaten gold leaf, which may be seen from the fact that an ounce of gold is sufficient to cover a wire fully 100 miles long. This flattened wire, being delicate and covered with the gold, is wound over the silk thread. In making silver lace the same method is used, except that the wire is not coated with gold.

GOLDSBORO, a city and the county seat of Wayne County, North Carolina, on the Neuse River, 47 miles southeast of Raleigh. It is on the Atlantic Coast Line, the Southern, and other railroads. The noteworthy buildings include an Odd Fellows' Orphan Home, several county and municipal buildings, the high school, and the Eastern Insane Asylum. Among the manufactures are tobacco, cotton-seed oil, furniture, machinery, pottery, and cotton goods. It has waterworks, electric lighting, and several county buildings. The surrounding country is a fertile agricultural region. It was settled in 1838 and incorporated in 1841. Population, 1900, 5,877; and in 1920, 11,296.

GOLDSBOROUGH (gōldz'b'rō), **Louis Malesherbes,** naval officer, born in Washington, D. C., Feb. 18, 1805; died there Feb. 20, 1877. At the age of seven years he entered the navy as midshipman, at twenty became lieutenant, and in 1827 was accorded the thanks of England for rescuing the *Comet* from Greek pirates. In 1847 he commanded the frigate *Ohio* at Vera Cruz, and after the Mexican War became superintendent of the United States Naval Academy. He was flag officer of the *Minnesota* in 1861, became rear admiral in 1862, and had command of the European squadron in 1865. In 1873 he was placed on the retired list. His service covered a longer period than that of any naval officer of his time, and his duties were discharged efficiently.

GOLDSCHMIDT (gōlt'shmĭt), **Jenny Lind.** See **Jenny Lind.**

GOLDSMITH (gōld'smĭth), **Oliver,** writer of prose and poetry, born in Pallas, Longford County, Ireland, Nov. 10, 1728; died April 4, 1774. He was the son of a clergyman of the Established Church. At the age of six years he began his school studies in the village, but was interrupted for a time by an attack of smallpox. After attending various elementary schools, he entered Trinity College, Dublin, in 1745, his expenses being defrayed by an uncle, Thomas Contarine. He remained in the institution until securing the degree of bachelor. His uncle desired that he enter the ministry, but, after studying a short time, he was rejected by

the bishop. Subsequently he started on a tour to America, but only reached Cork. Soon after he lost in gambling $250, a sum of money given him to study law in London, and later he became a student of medicine at Edinburgh. After pursuing the study of chemistry and natural science for about eighteen months, he started on a tour through France, Switzerland, Germany, and Italy. A degree in medicine was given him at Padua, and he returned to London in 1756. After trying in vain to earn a competence by practicing medicine, teaching, and proofreading, he concluded to adopt a literary career.

OLIVER GOLDSMITH.

The first publication of Goldsmith was a translation of "Memoirs," a work published by Jean Marteilhe of Bergerac, which appeared under an assumed name. Shortly after he conducted departments in the *Monthly Review* and contributed to the *Public Ledger*. In 1759 he published "Inquiry into the Present State of Polite Literature in Europe," and contributed to *The Bee* and *The Ladies' Magazine*. He met Dr. Johnston for the first time in 1761 and through his aid was finally enabled to come in touch with literary clubs. "The Travelers" appeared in 1764 and "The Vicar of Wakefield" two years later, and from these he secured good returns by arousing public interest. Other publications include "The Good Natured Man," "The Deserted Village," "Roman History, "She Stoops to Conquer," "History of Animated Nature," "Life of Richard Nash," "Grecian History," History of England," "Citizen of the World," and "Retaliation."

The most popular of his poems are "The Travelers" and "The Deserted Village," while "The Vicar of Wakefield" is his best novel and is still widely read both in the homes and in schools. Goldsmith possessed the most excellent natural genius characterizing the writers of his time. He produced the best novels, the finest poems, and one of the most excellent comedies of the period. Though his manner was undignified and his traits were rather vain, impulsive, and extravagant, he was able to measure talent with any of his contemporaries. When secluded in his chamber and while by himself he appeared at his best. His works relating to history and nature studies are pleasing and popular, but they do not possess the high value by which his novels and poems are characterized.

GOLF, an outdoor game of Scottish origin, played with balls and clubs. It may be played on any greensward. The players number one or more on each side, and each is provided with a separate ball. The player who can land his ball in a given series of holes with the fewest strokes of his club is the most skillful. To place the ball in a proper position for striking off is called *teeing*, and the plot on which the game is played is termed the *putting ground*. The balls generally used are made of hard gutta-percha, about five inches in circumference, and the golf clubs are of various sizes and shapes. The latter include those known as driver, cleek, iron, lofting iron, mashie, niblick, and putter. A large amount of literature has been published on the subject, and the rules governing the game differ somewhat according to the country in which it is played. Many clubs are maintained in Canada and the United States, and frequent contests for national and international championships take place. The Royal Montreal Golf Club, organized in 1873, is one of the most noted in Canada. Those of the United States are very numerous, including the United States Golf Association, the Chicago Golf Club, the Newport Golf Club, the Florida Golf Association, etc. Most of the associations are governed by the rules of the Saint Andrew's Club of Scotland.

GOLIATH (go-lī'ath), the celebrated giant of Gath, whom David slew. According to Josephus and the Septuagint translation of the Bible, he was four cubits and a span, but according to other translations, six cubits and a span. Counting the cubit twenty-one inches, he was about eleven feet tall. An account of the death of Goliath is given in I. Sam. xvii.

GOMEZ (gō'māz), **Maximo**, Cuban patriot, born of Spanish parentage in Bani, San Domingo, in 1838; died June 17, 1905. He served in the Spanish army during the revolt in San Domingo and accompanied the imperial troops to Cuba. While in the latter island he became displeased with the arbitrary Spanish government and withdrew from the military service. He joined the insurgents at the outbreak of the Ten Years' War in 1868 and received an important command under the Cuban president. During this war he aided in the capture of Bayamo, Tunas, Santa Cruz and Cascorro, and took part in the battles of Las Guasimas and Calo Sico. Later he invaded Santa Clara, was promoted to the rank of major general for distinguished service and soon after became commander in chief. When peace was concluded in 1878, he settled in Jamaica and later went to San Domingo. At the latter place he engaged in agriculture until sent for by Marti, the Cuban revolutionary president, at the beginning of the revolution of 1895. His military skill and extraordinary bravery made it possible for the Cuban army to engage the Spaniards until the intervention by the United States in 1898.

LIKENESS IN CLAY OF SAMUEL GOMPERS

Gomez, Antonio Maceo, and Calixto Garcia were the three leaders of greatest eminence in the last revolution.

GOMPERS (gŏm'pĕrz), **Samuel**, American economist, born in London, England, Jan. 27, 1850; and died Dec. 13, 1924. He studied at night schools, while working during the day as a shoemaker and later as a cigarmaker. In 1867 he came to the United States and soon after joined the International Cigarmakers' Union. His ability as a labor leader caused him to be elected to various offices in that organization, including the presidency. In 1882 he was chosen president of the American Federation of Labor, in which position he served about thirty years. In 1894 he founded the *American Federationist,* a monthly journal devoted to the discussion of the labor question. He gave much time to the study of labor associations, thorough organization, and advocated shorter hours for workingmen. As a lecturer he exercised a wide range of influence, advocating among other things a graduated income tax, the arbitration of differences between employers and employees, and a curtailment and abolition of trusts. He contributed much of value to the movement for an enlargement of municipal improvement through public ownership. In 1908 Justice Wright of the supreme court of the District of Columbia sentenced him as president of the American Federation of Labor, John Mitchell as vice-president, and Frank Morrison as secretary to jail for contempt of court in the Buck's Stove Company case, but was exonorated by a higher court. He was made a member of the Council of National Defense in 1917.

SAMUEL GOMPERS.

GONDOLA (gŏn'dō-lȧ), a class of barges used at Venice to navigate the canals. A gondola of medium size is rowed by one man, has seats amidships, and is about thirty feet long and four wide. The ends terminate with pointed projections about six feet high. Usually the larger sizes are rowed by two men, one at either end, each using a single oar.

GONG (gŏng), a musical instrument shaped like a tambourine, made of copper alloy, and struck by a padded drumstick. It gives out a combination of harmonies, serving to produce signals and to add intensity to martial music.

GONIOMETER (gō-nĭ-ŏm'ĕ-tĕr), an instrument for measuring the angles formed by the faces of crystals. It consists of a graduated semicircular arc with a fixed and a movable radius, between which the crystal is placed, each radius being made to coincide with the plane of one of its faces. The angle of their opening may then be read off on the arc. This instrument is called *Hauy's goniometer,* and it cannot be depended upon for obtaining absolutely accurate results. A more complicated instrument has crystals with clear faces, which distinctly reflect the image of a dark line across a clear light, and its graduated arc is furnished with a vernier, by which the degrees are divided into minutes.

GONSALVO DE CORDOVA (gŏn-säl'vō dā kôr'dō-vä), famous warrior, called the Great Captain, born in Montilla, near Cordova, Spain, March 16, 1453; died in Granada, Dec. 2, 1515. He first distinguished himself in 1475 during the war between Spain and Portugal. Later he served with distinction against the Moors and continued aggressive until Granada was conquered in 1492. Three years later he joined Ferdinand II., King of Naples, against the French, and succeeded in expelling the latter from Italy. In 1498 he returned to Spain, was made Duke of San Angelo, and again proceeded to Italy, where he gained several victories over the Turks and French. The jealousy of the king caused his recall and he was deprived of the viceroyalty of Naples, to which office he had been promoted. Shortly after he settled in Granada, remaining there until his death.

GOODALL (gŏŏd'ȧl), **Frederick**, artist, born in London, England, in 1822; died July 29, 1904. He was a son of Edward Goodall (1795-1870), a line engraver, and studied under the direction of his father. In 1839 he exhibited his first picture at the Royal Academy, entitled "Finding the Dead Body of a Miner by Torch-light." He visted Venice and Egypt in 1857, where he studied the classic subjects, and in 1863 was made a member of the Royal Academy. Among his chief productions are "The Return from a Christening," "Village Festival," "Rising of the Nile," "Rachel and Her Flock," "The Tired Soldier," "Entering Church," and "The Time of Roses."

GOODE, George Brown, ichthyologist, born in New Albany, Indiana, Feb. 13, 1851; died in Washington, D. C., Sept. 6, 1896. After graduating at Wesleyan University in 1870, he became teacher of natural history at that institution, and in 1873 received an appointment on the staff of the Smithsonian Institution. In 1876 he was director of the natural history division of the United States government at the Centennial Exhibition. He was United States fish commissioner at expositions held in Berlin, London, New Orleans, Chicago, Atlanta, and several other cities. In 1887 he succeeded S. F. Baird as fish commissioner of the United States. Among his works of value are "American Fisheries," "Game Fishes in the United States,"

"Natural History of the Bermudas," and "Oceanic Ichthyology."

GOOD FRIDAY, the fast kept in memory of the crucifixion of Christ, on the Friday before Easter. Nearly all the Protestant and Catholic churches observe the feast with much solemnity. It is named *good* because of the beneficent effect that comes from keeping the day, and during its observance special prayers are included for all classes of people.

GOODRICH (gŏŏd'rĭch), **Samuel Griswold,** author, born in Ridgefield, Conn., Aug. 19, 1793; died May 9, 1860. He is best known by the pseudonym, "Peter Parley." His productions and compilations include about 170 books for children and youth, besides a number of others for adult readers. He was consul in Paris during President Fillmore's administration, in 1851-55, and while there published a work in French, in which he reviewed the geography and history of America. Among his productions are "History of All Nations," "Recollections of a Lifetime," "Sketches from a Student's Window," and "Outcast and other Poems."

GOOD TEMPLARS, Independent Order of, a total abstinence society organized in New York City in 1851. In 1859 it adopted a platform of absolute prohibition, no license, and total abstinence. It organized branch lodges in Europe in 1868, and in 1870 established a grand lodge in England. Both sexes are admitted and adults and juvenile members are recognized, though in different branches. About fifty official periodicals are issued in different languages. At present branch organizations are maintained in all parts of the civilized world. The membership in the main organization is 416,125, while the juvenile branch has 181,840 members.

GOOD WILL, the advantage of an established reputation to the interest of a particular business. It is sometimes described as a favorable disposition of persons to extend their patronage to a particular line of trade, or a certain locality, which is considered a benefit in addition to the capital invested. The good will of a business is often sold with it, hence the purchaser receives a promise, either oral or written, that the person or company selling will not engage in the same business in the vicinity for a definite time. In cases where the good will is purchased along with the business, it is an advantage to have an expressed agreement that the former owner will not engage in the same or a similar business, and it should state some particular sum to be forfeited as liquidated damages in case the agreement is violated.

GOODWIN (gŏŏd'wĭn), **Nathaniel Carl,** actor, born in Boston, Mass., in 1857. He studied for the stage in his native city and made his début at the Howard Athenaeum in 1874, appearing successfully in "Law in New York." Afterward he appeared 150 nights in succession as *Captain Crosstree* in the burlesque "Black-eyed Susan." In 1877 he married Eliza Weathersby, an actress, and his company toured under her name a number of years. He played in England in 1891 and subsequently appeared in the leading cities of Canada and the United States. The plays in which he appeared to the best advantage include "An American Citizen," "A Gold Mine," "The Cowboy and the Lady," "A Gilded Fool," "When We Were Twenty-one," "In Mizzoura," and "Lend Me Five Shillings." He died Jan. 31, 1919.

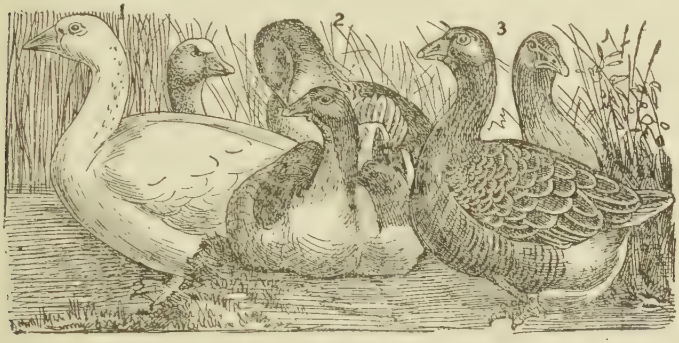
GOODWIN, William L., educator, born at Baie Verte, New Brunswick, April 30, 1856. He descended from a Massachusetts family that came to New Brunswick with Monckton's army in 1754. After attending the Mount Allison University in New Brunswick, he studied at the universities of Edinburgh and Heidelberg, and in 1879 became a teacher of chemistry in the University of Edinburgh. In 1893 he was chosen director of the School of Mining in Kingston, Canada, where he taught and directed with eminent success for many years. His writings include a number of reports and translations from the German. He is the author of "A Text-book of Chemistry."

GOODWIN SANDS, a stretch of shifting sand banks off the coast of Kent, England. The region is dangerous to navigation and has been the scene of many noted shipwrecks. A ridge divides the sands into two portions, which, during low water, are partly uncovered.

GOODYEAR (gŏŏd'yĕr), **Charles,** inventor, born in New Haven, Conn., Dec. 29, 1800; died in New York City, July 1, 1860. He became a member of the firm of A. Goodyear & Sons when 21 years of age, engaging extensively in the manufacture of steel machinery, but in 1830 the company was compelled to suspend business on account of financial failures. Soon after he began to experiment in making India rubber. He discovered that a preserving effect is secured by applying nitric acid on rubber, but later he used sulphur for the same purpose, and in 1844 was granted a patent on vulcanized rubber. The rubber industry rapidly rose into prominence. Before his death there were about 500 uses for the product and about 65,000 persons were employed in its production in the leading manufacturing countries of the world. In 1851 he received medals at the exhibition at London and in 1855 at the Paris exposition. Napoleon III. awarded him the cross of the Legion of Honor, and other distinctions were accorded him on account of his valuable service to mankind.

GOOSE (gōōs), a web-footed bird of the duck family. In all species the body is large and heavy, the bill is conical, and the upper mandible is slightly hooked. The head is small, the neck is long, the wings are powerful, and the toes are short. Geese are migratory and

move from the polar regions toward the warmer zones on the approach of winter. They swim less than ducks and do not dive, but commonly search for food by submerging the head under water. The domestic goose is thought to have originated from the *Anser ferus,* the typical genus of the subfamily *Anserinae.* Many species of geese are grown, all of which are valuable for their flesh, eggs, and feathers. Most of the wild species are gray in color and the domestic breeds are largely white. An average-sized goose is two feet ten inches long, the extended wings measuring five feet in expanse. Among the geese of North America are the snow goose, white-front goose, bean goose, Canada goose, China goose, Toulouse goose, Pomeranian goose, and cravat goose. The Canada goose is the most widely distributed wild species in North America. Several of the species are noted for their longevity. There are instances on record showing that they live to an age of eighty years. The male is commonly called *gander.*



1. Snow goose; 2. Pomeranian goose; 3. Toulouse goose.

GOOSEBERRY (gōōz′bĕr-rў), a class of shrubs allied to currants, but differing from them in having thorny stems. They grow wild in North America and Eurasia, but have been greatly improved by cultivation. The leaves are three-lobed and the flowers are small and yellow in most species. The fruit is succulent and variously colored when ripe, as green, yellow, whitish, and red. Plants four years old bear the best quality of fruit. The berries are eaten as a dessert and form a favorite material for jelly, pie, vinegar, and preserves. New plants may be propagated from the seeds or from slips.

GOOSEBERRY.

GOOSEFOOT. See **Pigweed.**

GOPHER (gō′fĕr), a class of burrowing animals native to North America. The name was first applied by the French to the species which honeycomb the ground by burrowing. Among the common species are the gray burrowing squirrel, the striped squirrel, and the pocket gopher. All these are mammals. The pocket or pouched gopher has peculiar pouches on the sides of the head, which facilitate piling up mounds in fields and meadows. Gophers are destructive to corn in the early stages of growth.

GORAMY (gō′rà-mў), or **Gourami,** a fish in the fresh and brakish waters of China and the East Indies. The body is flat and short. It is covered with large scales and the dorsal and anal fins have numerous spines. The ventral fins are prolonged backward and have long filaments. In size these fish are from two to five feet long. They are remarkable for building nests at the breeding season, using stems and leaves of grasses for that purpose. The nest is watched by both the male and female to prevent intrusion by other fish until the spawn is hatched. It is considered a fine fish for the table and has been acclimated in Australia and other continents.

GORDIAN KNOT (gôr′dĭ-ạn nŏt), a knot bound by Gordius, a peasant of Phrygia, in tying the yoke of his chariot. This was done so intricately that the oracle of Delphi promised the empire of Asia to him who would untie it. When Alexander the Great arrived at Gordium, he wished to inspire his soldiers with courage and spread the belief among his enemies that he was destined to conquer. Accordingly, he cut the knot with his sword and claimed that he had fulfilled the oracle. To "cut the gordian knot" has since implied the removal of a difficulty by bold means.

GORDON (gôr′dŭn), **Charles George,** soldier, known as Chinese Gordon and Gordon Pasha, born in Woolwich, England, Jan. 23, 1833; died at Khartoum, Africa, Jan. 28, 1885. He descended from a family of soldiers, being the fourth son of General Gordon, and studied at the miltary academy of his native town. He and two brothers entered the army. In 1852 he was granted a commission in the royal engineers. His first work was to aid in planning fortifications at Milford Haven. In 1854 he was engaged in the Crimea, and there exhibited

the fearless fatalism by which his entire life was made serviceable to his country. He was ordered to China in 1860, where he witnessed the attack on the Summer Palace at Pekin, and secured a prize of $250 for his services. The general command of the Chinese forces was given him in 1863, in which capacity he led several successive campaigns, fighting thirty-three battles, in which he succeeded in suppressing the Taiping rebellion. Though but thirty years of age, he was brevetted major and attained successes that spread his renown to all countries. In 1863 he returned to England, where he pursued the ordinary duties of engineer at Gravesend until 1872, when he proceeded as commisioner to Bulgaria.

Khedive Ismail of Egypt employed him to survey the region of the Nile near the equatorial provinces, in which capacity he established fortified posts and suppressed the slave trade. On account of valuable service he was made pasha. Khedive Tewfik failed to give him support in his operations and he accordingly resigned his position and returned to England in 1880, where he was greeted with marked enthusiasm. Soon after he was appointed to command the royal engineers in Mauritius Island, where he became major-general and held command of the British troops until 1882. The moslem population having risen in the Sudan and defeated the Egyptians, Gordon was sent for the purpose of bringing the insurrectionists to terms.

Gordon left London in the early part of 1884 to proceed to Khartoum, and was accorded remarkable confidence by the officials of England. Reaching Cairo, he proceeded at once to Khartoum, where he was received with joy, and by well-directed efforts established order in that region. Soon after the Mahdi raised a large army, surrounded Khartoum, and laid a prolonged siege to that place. Gordon and his companions battled with marked bravery in defense of the city, but on Jan. 28, 1885, the Mahdi captured the place and promptly executed Gordon. Two days later a British army reached the city, but it came too late to save the commander. Gordon ranks with Cromwell for gallantry and exhibited the bravery of a Crusader. His devotion to fatalism made him daring and brave, while his excellent judgment and kindness of disposition secured for him the confidence of his soldiers. The story of his life reads like a fairy tale, but embodies only the achievements of a great man. Among his publications are "Letters from the Crimea," "Letters to His Sister," "Gordon at Khartoum," "Exploits in China," and "Reflections in Palestine."

GORDON, Charles William, author, born in Glengarry County, Ontario, in 1860. He graduated at Toronto University, studied theology at Knox College, and entered the ministry of the Presbyterian church. For some years he conducted missionary work in the northwestern part of Canada. Later he became pastor of a Presbyterian church in Winnipeg, where he exercised a wide influence in building up the cause of Christianity. His writings were issued largely under the pseudonym of Ralph Connor. Among his publications are "Black Rock," "The Man From Glengarry," "The Sky Pilot," "Glengarry School Days," "Beyond the Marshes," and "Ould Michael."

GORDON, John Brown, soldier and statesman, born in Upson County, Georgia, Feb. 6, 1832; died Jan. 9, 1904. His education was secured at the University of Georgia. He served in the Confederate army, rose rapidly to the rank of major general, and rendered efficient service in numerous battles. He attended the national Democratic conventions of 1868 and 1872, and in the latter year was elected to succeed Joshua Hill as United States Senator. In 1886-90 he was Governor of Georgia, elected to fill a vacancy in the Senate in 1890, and was reëlected in 1891. Gordon attained a wide reputation as a lecturer and was in popular demand in all parts of the country.

GORE (gôr), **Catharine Grace,** novelist, born in Nottingham, England, in 1799; died Jan. 27, 1861. She was the daughter of a wine merchant and in 1823 married Charles Arthur Gore. Her writings include about seventy works, treating chiefly of aristocratic life in England. They were popular at the time of publication, but are not read extensively at present. Among the chief works are "Cecil, a Peer," "The Ambassador's Wife," "The Days of Dupes," "The Queen of Denmark," "Modern Chivalry," "The Cabinet Minister," and "The School of Coquettes."

GORE, Christopher, jurist and statesman, born in Boston, Mass., Sept. 21, 1758; died March 1, 1827. After graduating from Harvard in 1776, he practiced law in Boston, and from 1789 to 1796 was United States district attorney for Massachusetts. In 1796 he served as commissioner with William Pinckney to settle claims against France, and remained in England for seven years. He returned to the United States in 1804, was elected Governor of Massachusetts in 1809, and became a United States Senator in 1814. Several colleges were remembered by donations, the principal gift being $100,000 to Harvard College. A library building was named Gore Hall in his honor.

GORE, Thomas Page, public man, born in Webster County, Mississippi, Dec. 10, 1870. He attended the schools at Walthall, Miss., and afterward studied in Cumberland University, Lebanon, Tenn. After being admitted to the bar, he practiced law and was elected a member of the council of Oklahoma in 1902. Five years later he was nominated as a Democrat for United States Senator, after which he was appointed to that office by the Governor. He was elected for a full term in 1909 and was

reëlected in 1915. Although totally blind, he achieved success as a public man.

GORGEY (gĕr'gĕ-ĭ), **Arthur,** general, born in Toporez, Hungary, Feb. 5, 1818. He received a military education at Tuln and was made a member of the Hungarian bodyguard and later lieutenant of Hussars. However, he soon took up the study of chemistry at Prague with the view of devoting his life to science, but in 1848 joined the revolutionary rising against Austria. Under an appointment from Kossuth, he purchased arms in Belgium and was made general commander of the Hungarian army. With an army of 40,000 men he compelled the Austrians to evacuate Pest, but he was defeated at Raab and Windischgrätz, and later was compelled to retreat over the Sturecz Mountains. In August, 1848, the Hungarians were defeated at the Battle of Temesvár, and in the same month Görgey surrendered his army of 24,000 men to the allied forces of Austrians and Russians. It was charged that his surrender was traitorous, but it was afterward shown that resistance to Austria was in vain. In 1868 he returned to Hungary, where he was not well received. He published "My Life and Acts in Hungary," which is a reply to the charge that he betrayed the Hungarians. He died May 21, 1916.

GORGONS (gôr'gŏnz), the name of three Grecian goddesses, known respectively as Euryale, Stheno, and Medusa. They were frightful in appearance. Their heads were entwined with serpents, the bodies were covered with scales, and from their mouths projected tusks like those of wild boars. The teeth were of brass, and they had long claws instead of hands. Those who ventured to look upon them turned to stone, but Perseus relieved humanity by slaying them, and the head of Medusa was placed in Minerva's shield.

GORILLA (gō-rĭl'lȧ), the name applied as early as the 5th century B. C. to the largest animal of the ape family, which is native to the western part of Africa. An adult gorilla is from five to six feet tall when standing erect. It has black hair on the back and reddish-brown to black on its belly. The shoulders are broad and massive, above which is a heavy neck and a somewhat conical head. It subsists chiefly on vegetables and fruits. The gorilla is allied to the chimpanzee, but is larger. In the number of teeth, height of the body while standing, bones in the hand, ribs, and brain structure it corresponds to man, though the brain measures only from 23 to 35 cubic inches, while in man it measures from 62 to 114 cubic inches. In physical strength the gorilla is powerful, being the strongest of the anthropoid apes. The voice resembles a bark, though it is like a roar when the animal becomes enraged. Gorillas live in familes and build hammocks in trees as places to sleep and rest.

GORILLA.
Male, female, and infant.

GORKY (gôr'kĕ), **Maxim,** author, born in Nizhni Novgorod, Russia, in 1868. His parents were poor and made him an apprentice to a shoemaker and later he was a baker and held a clerkship under a lawyer. Finding it impossible to succeed or secure an education in southern Russia, he traveled as a tramp in much of Russian territory. In this way he succeeded in gathering much material for his subsequent literary work and was brought in close contact with the poorer and lower classes, thus enabling him to interpret the life and thought of the common people. In 1905 he supported the revolution in Russia and joined Father Gapon in issuing tracts to arouse to action against the absolute government of Nicholas II. He produced a large number of novels and short stories, written in a rather pessimistic but in a peculiarly frank and incisive style. In 1909 he was exiled to Siberia, but escaped to Italy, where he lived a number of years. His collected works were published in 1901 at Saint Petersburg of which several German translations have been made. Foremost among his writings are "Foma Gordyéeff" and "Makar Chudra." He was assassinated Aug. 19, 1919.

MAXIM GORKY.

GORLITZ (gĕr'lĭts), a city of Germany, in the province of Silesia, 62 miles east of Dresden. It occupies a fine site on the Neisse River and has railway communication. The chief buildings include the Church of Saint Peter and Saint Paul (Protestant), the Gothic Frauenkirche, the city hall, and the public library. It has many gymnasiums and benevolent institutions and is the seat of the Upper Lusatian Scientific Society, which has a library of 75,000 volumes. The manufactures consist

chiefly of clothing, toys, machinery, cigars, earthenware, and jewelry. It has an extensive jobbing trade. Görlitz was founded about 1200. It was the capital of the Duchy of Görlitz from 1377 until 1396. In the 17th century it was annexed to Saxony and became a part of Prussia in 1815. Population, 1920, 85,790.

GORMAN (gôr'mạn), **Arthur Pue,** statesman, born in Howard County, Maryland, March 11, 1839; died June 4, 1906. After securing a public school education, he became a page in the United States Senate, in which position he served from 1852 to 1866. In 1869 he was appointed collector of internal revenue for Maryland, and in 1872 was made president of the Chesapeake and Ohio Canal Company, serving in that capacity about twenty years. He was a member of the Maryland House of Representatives in 1869-75, State Senator in 1875-81, and United States Senator in 1881-99. Gorman exercised much influence in the legislation of his State as well as in the national government. He supported the Democratic party, and was an efficient leader in favor of civil service reform and international commerce.

GORTSCHAKOFF (gôrt-chä-kôf'), **Alexandra Michaelovitch,** statesman, born in Saint Petersburg, Russia, July 16, 1798; died in Baden-Baden, Germany, March 11, 1883. After being educated at the Lyceum of Tsarskoe-Selo, he entered the diplomatic service in 1824, served as ambassador at Vienna in 1854-56, and was then appointed minister of foreign affairs. In 1863 he became chancellor of the empire, and was the most influential minister of Europe until the ascendency of Bismarck. During the Franco-German War, in 1870-71, he was friendly to German policies, and took occasion to announce Russia's determination not to be restricted in the navigation right of the Black Sea. This demand was consented to by a conference in 1871. In 1878 he participated in the Berlin conference, and in 1882 retired from public life and settled in Baden-Baden. To his able diplomacy the recent development of Russian commerce is largely indebted.

GORTSCHAKOFF, Mikhail, general, born in Saint Petersburg, Russia, in 1795; died May 30, 1861. He received a careful military training and in 1828 distinguished himself in the Turkish War. In 1831 he operated successfully against the Poles, taking part in the Battle of Ostrolenka, and in 1849 commanded a force during the invasion of Hungary. In 1853 he commanded a Russian army in the provinces of the Danube and the following year operated against Bessarabia. He directed the defense of Sebastopol in 1855. Alexander II. appointed him governor of Poland.

GOSCHEN (gō'shẹn), **George Joachim,** statesman, born in London, England, Aug. 10, 1831; died Feb. 7, 1907. He descended from a German family. After studying at Oxford, he engaged in mercantile business in 1853, and ten years later was elected as a Liberal to Parliament, serving on many important committees until he withdrew in 1878. In 1883 he was sent as commissioner to treat with the Sultan at Constantinople, and in 1887 succeeded Lord Churchill as Chancellor of the Exchequer in the Salisbury ministry. He became a member of Lord Salisbury's cabinet in 1895 and was made Lord of the Admiralty. The profound scholarship and wisdom manifested in public life led to his selection as lord rector of Aberdeen University in 1888. He published "Theory of Foreign Exchange."

GOSHAWK (gŏs'hạk), the name of several species of hawks widely diffused in Europe and Asia. They include five or six species and are distinguished from the true falcons by a festoon on the edge of the upper mandible, while the latter have a sharp tooth. Their wings are shorter, reaching to the middle of the tail. In flying at game and other birds, they do not rise in the air to descend upon them, but pursue a straight line in making the attack. The goshawk native to America is larger than the European species. It is abundant in Canada and Alaska during the summer and moves southward to the southern part of the United States during the fall. Locally it is known as the chicken hawk or hen hawk.

GOSHEN (gō'shẹn), an ancient district of Egypt, the territory assigned to Jacob and his family after they left their native land. It included the region around Heroopolis, near the eastern border of the Nile delta, but its exact boundaries are not known. Goshen was spoken of as fertile land and suited for grazing. The Hebrews resided here until they were enslaved by the Egyptians, after which they were delivered by Moses, who led them through the wilderness and within sight of Canaan.

GOSHEN, a city in Indiana, county seat of Elkhart County, on the Elkhorn River, midway between Chicago and Toledo. It is on the Big Four, the New York Central, and several electric interurban railroads. The public library, the high school, and the county courthouse are its chief buildings. An abundance of water power is secured from the Elkhart River, which has facilitated building up many manufacturing establishments. Among the manufactures are wagons, plows, flour, oil, woolen goods, machinery, and cigars. The lumber, grain, and fruit trade is extensive. It has regularly platted streets, gas and electric lighting, brick and macadam pavements, and a municipal system of waterworks. Population, 1900, 7,810; in 1920, 9,525.

GOSNOLD (gŏs'nŭld), **Bartholomew,** navigator, born in England about 1550; died in Virginia, Aug. 22, 1607. He became connected with Sir Walter Raleigh in the enterprise of founding a colony in Virginia, and sailed from Falmouth in 1602 with a ship and twenty colonists. After a voyage of seven weeks he

reached the coast of Maine, and, passing southward, discovered Cape Cod. After spending a severe winter, the colonists returned to England, but he sailed to America again in 1606 with three small ships and about one hundred colonists. It was this expediton that founded the first permanent settlement in America, at Jamestown, on the James River, in 1607.

GOSPEL (gŏs'pĕl), meaning a joyful message, any one of the four histories of the life and teachings of Christ written by Matthew, Mark, Luke, and John. The first three give a summary or synopsis of the ministry of Christ and were probably written between 60 and 70 A. D. It is certain that they were completed before the destruction of Jerusalem, to which they refer as a future event. The Gospel of John was probably written near the close of the first century, at Ephesus, since writers generally assign its completion to the year 90. They are not complete biographies of Jesus, but contain an account of the events that appeared most important to each evangelist as a means of leading the people to believe that Christ is the Savior of mankind. The Gospels were received and used in the churches before the end of the 2d century, which is confirmed by Origen and other ante-Nicene fathers of the Church.

GOSSAMER (gŏs'sȧ-mĕr), a term applied by German and French writers to the flakelike webs seen floating in the air on calm autumn days. They are composed of silk emitted by many species of immature spiders. Being lighter than the atmosphere, they float in the gentle breezes. The threads are spun to connect different blades and plants, and, by reason of the loosening effect resulting from autumnal breezes and the shrinking of plants, the gossamer becomes detached and is carried to various heights and frequently long distances. The name *gossamer* applies to a light waterproof cloak worn by ladies.

GOSSE (gŏs), **Philip Henry,** naturalist, born in Worcester, England, April 10, 1810; died Aug. 23, 1888. He came to America in 1827, engaging as a mercantile clerk in Newfoundland. Later he became a farmer in Canada, taught school in Alabama, and studied as a naturalist in Jamaica. In 1840 he returned to England, where he published "The Canadian Naturalist." Later he wrote other works, among them "History of the Jews," "Birds, Reptiles, and Fishes," "Land and Sea," and "Great Atlas Moth of Asia." His son, Edmund William Gosse, born in London, Sept. 21, 1849, is the author of several valuable works. Among his productions are "Studies in Northern Literature," "From Shakespeare to Pope," "The Jacobean Poets," and "History of Eighteeenth Century Literature."

GOTHA (gō'tȧ), a city of Germany, capital of the duchy of Gotha, fifteen miles southwest of Erfurt, with which it is connected by railway. It is located near the northern border of the Thuringian Forest, is well platted, and has a large number of fine and substantial buildings. The palace of Friedenstein, a massive structure of the 17th century, contains a library of 200,000 volumes. Other buildings of note include the museum, an art gallery, a theater, the post office, and the town hall. The manufactures consist chiefly of porcelain, stoves, cotton and woolen goods, boots and shoes, machinery, and tobacco products. It has extensive machine shops and railway repair shops. Gotha passed to the electors of Saxony in 1440 and has been the capital of the duchy of Gotha nearly 400 years. Population, 1920, 42,407.

GOTHARD, or Gotthard, Saint, a mountain group in Switzerland, belonging to the Helvetian Alps, and famous for the Saint Gothard pass over the Alps. The highest peak of this mountain group is about 12,000 feet, and the point at which the Saint Gothard Hospice stands is 10,810 feet. A carriage pass across the Alps was completed in 1832. One of the most important railroad tunnels in the world, known as Saint Gothard's, passes through the mountains between Airolo on the south and Göschenen on the north, and by it the railroad systems of Italy, Switzerland, and Germany are connected. The tunnel was commenced in 1872 and opened for traffic in 1882. It is nine and one-half miles long and cost about $12,000,000.

GOTHENBURG. See **Gottenburg.**

GOTHIC ARCHITECTURE (gŏth'ĭk), the style of architecture which is characterized by the pointed arch and makes use of the cross-vault or groin-vault. In a wider sense it includes the forms introduced by the barbaric tribes that overthrew Rome. It prevailed largely in Europe from the 6th to the 16th century, though in a newer classification it dates only from the 11th century, when it took on an improved form. The term is generally used in history to distinguish the Gothic from the classic architecture as well as from the transition styles introduced by the Norman-Franks. Besides the pointed arches, it is marked by a prolongation of vertical lines, an absence of square edges, a want of columns and rectangular surfaces and the general substitution of various surfaces and grouped shafts. It stands in contrast to other styles because of its multiplication of different ornamental forms. Excessive decoration of the perpendicular lines and ornamentation of the horizontal by starring caused the Gothic to lose favor, but it is now reviving somewhat. Many of the most noted historic buildings of Germany, Spain, France, England, Norway, Sweden, and other countries of Western Europe are in the Gothic style. The two principal forms of the Gothic architecture are known as the *perpendicular* and the *decorated.* The former originated in Germany and the latter in England.

GOTHLAND (gŏt'lănd), an island in the Baltic Sea, about 52 miles east of Sweden, to

which country it belongs. It has a rocky coast, but much of the soil is fertile. The surface is about 250 feet above sea level and the area is 1,210 square miles. It has several good harbors. The larger cities are connected by railway and carry on an important trade in cereals and fish. Wisby is the chief city, having a population of 7,645. The island became a part of Sweden in the 9th century, was captured several times by the Danes, and has belonged permanently to Sweden since 1645. Population, 1906, 53,290; in 1919, 56,920.

GOTHS (gŏths), an ancient race of German people who occupied a large portion of Europe and Asiatic Russia. In the early part of the 3d century they inhabited the country north of the Black Sea, and by numerous conquests came into possession of much territory and powerful military forces. They were divided into three great tribes, known as Ostrogoths (eastern Goths), Visigoths (western Goths), and Moesogoths (the Goths of Bulgaria). Before their division into the eastern and western branches, their king, Filmer, led an army and occupied Euxine, from which region the different historical branches sprang. War was waged by their king, Ostrogotha, against the Romans in 248, and extensive contests were conducted in the eastern provinces of Rome for eighteen years, but subsequently Claudius defeated them. Emperor Aurelian was compelled, in 272, to cede the province of Dacia to them, where the Visigoths formed their chief settlement, while the Ostrogoths remained in the region of the Black Sea. Ermanric attained much power and included the region from the Gulf of Bothnia to the Black Sea, extending far toward the east. Internal disputes caused a division in the year 369, after which the Visigoths formed a separate kingdom west of the Danube and the Ostrogoths became confined to the section east of that river. Alaric, King of the Visigoths, invaded Greece in 396, conquered the Peloponnesus, and obtained the government of Illyria. He invaded Italy in 409-10, captured Rome, and carried away much of the riches of that city. Shortly after the death of Alaric, in 410, the Visigoths invaded Spain and Gaul. In the 5th century they established the seat of their government at Toulouse, their principal provinces being Languedoc, Provence, and Catalonia. The Visigoths were finally vanquished by the Moors, who crossed into Spain from Africa, and for many years constituted the principal factor in the Iberian Peninsula. Roderick, who died in 711, was the last king of the Visigoths.

The kingdom of the Ostrogoths was overthrown by the Huns in 375, after which they largely followed a nomadic life. At the time Attila, the Hun, invaded Gaul he was supported by a vast horde of Ostrogothic warriors, and, when the empire of the Huns came to an end, they settled near Vienna, and later in Moesia, now called Bulgaria, from which they became known as Moesogoths. The Ostrogoths attained vast military power under Theodoric. This ruler was educated at Constantinople as a Roman nobleman and in 474 was made king by the Ostrogoths. Odoacer the Usurper conquered the western empire in 476. In 489 Theodoric invaded Italy with a vast army, and four years later was recognized king. He reigned successfully until his death in 526, and in 554 the kingdom came to an end. During its greatest prosperity the Ostrogothic kingdom included Italy and large portions of Switzerland, Hungary, Austria, and Rumania. Subsequently the Gothic people lost their identity as a nation and became assimilated by other peoples.

The German, English, and Scandinavian languages may be traced to the Gothic tongue, the first two to the Visigothic and the last to the Ostrogothic. A translation of the Bible into Gothic was made by Bishop Wulfila, a man of profound learning, about 375. Several portions of this work are extant, with which are included a number of explanations of the gospels. The language attained its highest literary culture during the occupation of Italy, though it did not long survive the Gothic peoples. A number of literary works and the translations from the Bible are of great value in studying the growth and history of the early Germanic languages.

GOTTENBURG (gŏt'ẹn-bûrg), or **Gothenburg**, a city and seaport of Sweden, called Göteborg in Swedish. It is situated on the Cattegat, about 25 miles southwest of Stockholm, and has an excellent harbor and extensive canal and railroad connections. Among the noteworthy buildings are the market place, the cathedral, the governor's palace, the public library, and the arsenal. It has a fine museum and a scientific society founded in 1778. Systems of gas and electric lighting, stone and macadam pavements, and electric street railways are maintained. The city ranks among the best built cities of Sweden, having extensive shipbuilding yards, excellent institutions of learning, and important factories. Among the products are cotton and woolen goods, sail cloth, spirituous beverages, machinery, sugar, tobacco, paper, glass, and furniture. It is important for its exports of fish, iron, copper, tar, pitch, and lumber. The imports include cereals, food products, and salt. Since 1865 a successful system of municipal regulation has been in force, under which companies are licensed for the management of public houses, and, after retaining six per cent. as profit on the capital invested, they turn the balance over to the city. Gottenburg was founded in 1619 by Dutch settlers, who platted the town and built several canals. In 1806, during the continental blockade, it rose to commercial importance. Population, 1906, 156,927; in 1923, 205,579.

GÖTTINGEN (gĕt'tĭng-ẹn), a city of Ger-

many, in the province of Hanover, on the Leine River, about 58 miles south of Hanover. It has connections by several railroads, a fine school system, and a hospital. However, it is famous chiefly as the seat of the celebrated University of Göttingen, which was founded in 1734 by George II., King of England and Elector of Hanover, and formally opened in 1737. The university contains an observatory, a museum, botanical gardens, anatomical collections, and a library with 515,000 volumes and 6,000 manuscripts. It has 135 professors, 2,550 students, and an alumni that includes many of the eminent German masters, among them Blumenbach, Gieseler, Gauss, Herbart, Müller, the Grimm brothers, and Weber. Among the illustrious Americans who studied there are Longfellow and Bancroft. The city is supplied with all municipal facilities, such as telephones and electric conveniences. It has manufactures of woolen and cotton goods, scientific instruments, chemicals, and musical instruments. Göttingen was founded in the 10th century and was prominent as a member of the Hanseatic League. Population, 1922, 34,081.

GOTTSCHALK (gŏt'shälk), **Louis Moreau,** pianist and composer, born in New Orleans, La., May 8, 1829; died in Rio Janeiro, Brazil, Dec. 18, 1869. He studied at Paris and in 1848 appeared there in public concerts with much success. Subsequently he traveled in Spain, Germany, and Switzerland and returned to the United States in 1853. After meeting with an enthusiastic reception at Boston, he appeared in the large cities of the United States, Canada, Mexico, the West Indies, and Brazil, his death occurring while filling an engagement at Rio Janeiro. His composition, "The Last Hope," is his masterpiece.

GOUGH (gŏf), **John Bartholomew,** temperance orator, born in Sandhurst, England, Oct. 22, 1817; died in Philadelphia, Pa., Feb. 18, 1886. He settled in the United States shortly after the death of his father, in 1829, worked on a farm in Oneida County, New York, and in 1831 became a bookbinder in New York City. His early habits were very irregular, but he reformed and devoted himself with much zeal to the temperance cause. In 1853 he visited England and spent two years lecturing in that country. Among his publications are "Temperance Lectures," "Autobiography," and "Sunlight and Shadow."

GOUJON (gōō-zhôn'), **Jean,** sculptor and architect, born in France about 1520; died in 1572. He is regarded the most celebrated sculptor of France in the 16th century, and it is thought that he was a native of Normandy. In 1542 he completed a statue of Archbishop Georges II., now in the Cathedral of Rouen, and subsequently made a series of fountains in Paris. These were formerly located near the Cemetery of the Innocents, but were removed to the public park, where they are still preserved. He worked upon decorations of the Louvre. He was classed as a Huguenot, and it is supposed that he perished in the massacre of Saint Bartholomew.

GOULD (gōōld), **Benjamin Apthorp,** astronomer and statistician, born in Boston, Mass., Sept. 27, 1824; died Nov. 27, 1896. He graduated at Harvard in 1844 and at Göttingen, Germany, in 1848, and spent some time in general research, traveling in continental Europe. On his return to America, in 1848, he published the *Astronomical Journal.* In 1851 he took charge of the United States coast survey, and discovered a connecting series of measures in longitude from New Orleans to the Ural Mountains. From 1856 to 1859 he superintended the Dudley Observatory in Albany, N. Y., and in 1868-85 had charge of the National Observatory at Cordova, Argentina, where he made precise photographs of many southern constellations. In 1885 he returned to the United States and resumed the publication of his *Astronomical Journal,* in which many interesting reports appeared. His astronomical observations extended to 73,165 stars. His death occurred in Cambridge, Mass., from falling accidentally. Among his published works are "Zone Catalogue," "Statistics of American Soldiers," and "Trans-Atlantic Longitude."

GOULD, George Jay, capitalist, son of Jay Gould, born in New York City, Feb. 6, 1864. He was educated by tutors and in private schools and in 1886 married Edith Kingdon, an actress. He assumed direction of the railroad and other interests of his father, and in 1888 became president of the Little Rock and Fort Smith Railway. Subsequently he held like positions in a number of railroads, including the Great Northern and the Missouri Pacific, and in 1892 became president of the Manhattan Elevated Railway of New York City. During his administration, by means of careful and energetic management, the Gould interests were greatly extended in railway, telegraph, life insurance, banks, steamship lines, and other commercial enterprises. He died May 16, 1923.

GOULD, Helen Miller, philanthropist, born in New York City, June 20, 1868. Her father, Jay Gould, left her a large estate, much of which she devoted to useful purposes. In the beginning of the war with Spain she gave the United States government $100,000, and presented $50,000 with which to secure supplies and relief for soldiers in hospitals. Subsequently she furnished the means to erect the library building of the New York

HELEN M. GOULD.

University, in which is maintained the famous "Hall of Fame." She equipped the Sailors' Young Men's Christian Association building in New York City at an expenditure of $50,000, made several liberal gifts to Rutgers College, and aided by personal effort many other institutions. She made a gift of $250,000 to erect the Railroad Y. M. C. A. building at Saint Louis, Mo. In 1913 she married Finley J. Shepard.

GOULD, Jay, financier, born in Roxbury, N. Y., in May, 1836; died Dec. 2, 1892. Besides attending the village school, he studied a few months at the academy in Hobart, N. Y., and began his life work as a surveyor. In 1856 he engaged in the tanning and lumber business, became associated with James Fisk, Jr., and engaged in the purchase of railroad bonds in New York City in 1859. Later he was chosen president of the Erie Railway Company, invested largely in stock of other railways, and secured interests in telegraph companies. In 1881 he aided in promoting the elevated railroad system of New York City. It was estimated in 1887 that he controlled over 13,000 miles of railroads, or about one-third of the entire mileage then in the United States. He was remarkable as a financier in that he began without means and at the time of his death possessed an estate valued at $70,000,000.

GOUNOD (gōō-nō'), **Charles François,** operatic composer, born in Paris, France, June 17, 1818; died Oct. 18, 1893. He studied at the Paris Conservatory and later completed his musical training in Rome, giving special attention to sacred music. On returning to Paris, in 1843, he was elected director of music at the Catholic Foreign Mission, and soon after published numerous musical productions. Among the composers of the 19th century he holds high rank. His productions include "Gounod's Sappho," "Romeo and Juliet," "Redemption," "Gounod's Faust," "Gallia," and the cantata "Ferdinand." In 1866 he became a member of the French Institute and was granted a badge of the Legion of Honor.

GOURD (gōrd), a plant related to the cucumber, having large yellow flowers, ovate or

GOURDS.

oblong fruit, trailing stems, and hairy leaves. Many varieties have been produced by propagation, some of which are edible, and others yield a tough outer shell useful for bottles, dippers, and other household vessels. Several species are native to Astrakhan and the East and West Indies, but many have been naturalized and are cultivated in America and Europe. The gourd family includes the watermelon, muskmelon, squash, cucumber, pumpkin, and musk gourd. Many members of this family of plants have been highly improved by cultivation. They furnish valuable food for man and cattle and form important articles of commerce.

GOUT, a constitutional disorder arising from an excess of uric acid in the blood, caused by an impaired condition of the kidneys. It arises from excessive indulgence in wines, fermented beverages, and inactivity, and is not uncommon among those who partake of undue quantities of nitrogeneous foods. However, it is inherited by some individuals, but seldom appears before the age of thirty. Gout is more common among males than among females. It is characterized by pains in the joints, but more commonly affects the great toe, the heel, and the calf of the leg. Gout affecting the internal organs is most dangerous. The best preventives are regular habits, proper diet, and abstinence from alcoholic drink.

GOVAN (gŭv'ăn), a city of Lanark County, Scotland, on the Clyde River, immediately west of Glasgow, of which it is a suburb. It contains extensive manufactures and has important shipbuilding yards. Electric and steam railways connect it with Glasgow and other cities. It was one of the largest towns of Scotland in the 16th century, when it was known as Meikle Govane. Population, 1921, 89,725.

GOVERNMENT (gŭv'ĕrn-mĕnt), that power or influence which is exercised by one person or thing over others. The mainspring of a watch, gravitation, the parental head of a family, and civil officers are agencies that govern in their respective spheres of influence. The term is applied most commonly to the power exercised by recognized officers of a state or nation. Government is an essential element in civilization, indeed, without it citizens would be unprotected in their personal safety and security of property against the attacks of lawless vandals and marauders. Thus, the term government implies the organized means of a state or nation maintained to vouchsafe protection to the industrial, political, social, and moral rights of the people, and for perpetuating its own existence.

Governments vary in their form, the most ignorant and barbarous people being governed by tyrants and despots, while the more intelligent and law-abiding are governed under a system in which each individual has certain recognized rights to be protected, and certain powers which he may exercise in promoting and enforcing the laws. The principal forms of government known in history are patriarchal, theocratical, monarchial, aristocratic, demo-

cratic, and republican. In general the *patriarchal* is the family government and existed as the first and oldest. The father is the recognized head of the family, and exercises an influence in shaping the welfare of the household. Though patriarchal governments do not exist at present, yet the family government is the true basis of national security and intelligence. In a *theocratic* form of government the people are governed as were the Israelites, by the immediate direction and administration of God.

In a *monarchial* government a monarch is the supreme ruler, who bears the title of king, emperor, czar, sultan, pasha, or some other term implying sovereignity. Monarchies are *limited* when the power of the sovereign is restricted by a constitution and established laws, but *absolute* when unlimited power is vested in the chief ruler, and he is responsible to no earthly tribunal. Morocco and Persia are classed as absolute monarchies, while Japan, England, Italy, Sweden, and Spain are limited. A *hereditary* monarchy is one in which the sovereign inherits the title to the throne, and in an *elective* monarchy the sovereign owes his position to an election by the people. In an *aristocratic* government the supreme power is vested in a few men of wealth, usually comprising the clergy and a titled nobility, though both these classes are not uncommon in monarchial governments. A *democratic* government is one in which the people exercise absolute power, and not only have a voice in making the laws, but in seeing that they are enforced. A *republican* government is representative. In it the people authorize officers to serve them in making and enforcing the laws. The government of the United States is sometimes called a *democratic-republican* government for the reason that the people may direct their lawmakers to some extent and are represented by them in making laws, while by public approval or disapproval they may induce the officers chosen to administer the laws wisely and justly. On the other hand, Canada is governed as a *limited monarchy,* in which the people have large powers in managing local and provincial affairs, while the general government of the country is vested by heredity in the crown of Great Britain.

Three distinct branches are recognized in every well-established government—the executive, legislative, and judicial. *Executive* power in the United States government is vested in the President, who is advised in his duties by nine cabinet officers. The cabinet officers are appointed by the President with the consent of the Senate. *Legislative* power is vested in a Congress, which contains two branches—the Senate and House of Representatives. The Senate is composed of two members from each State, who hold office for six years. Members of the House of Representatives, who are elected by a popular vote in the states, or in various congressional districts of each State, hold office for two years. The *judicial* department, consisting of a system of Federal courts, culminates in a Supreme Court, which is composed of a Chief Justice and eight associate justices. These are appointed by the President with the consent of the Senate and hold office during good behavior. Each State has a local government modeled after the essential features of the general government, and which the Constitution of the United States guarantees to maintain. The executive officer of the State is the Governor, the legislative power is vested in the General Assembly, and the judicial authority is in a Supreme Court having jurisdiction within the particular State. In Canada the government is very similar, but the Governor General, who represents the Crown, takes the place of the President. This official is the chief executive officer within the Dominion and is appointed by the home government. Each Province, instead of a governor, has a Lieutenant Governor, who is appointed by the Governor General. The legislative functions for the country and the provinces are exercised respectively by the Dominion and the provincial parliaments.

Among the principal resources of the general government of most countries are customs duties, internal revenue taxes, proceeds of the sale of public lands, and its ability to borrow money. The required amount of revenue is devoted to the general expenses of the government, and all surplus revenue is expended for the gradual reduction of the public debt or for constructing internal and general improvements.

GOVERNOR (gŭv'ĕrn-ẽr), a mechanical device serving to regulate the admission of steam to an engine according to the rate of velocity. It is formed of a vertical shaft, on which two balls are suspended, and, when the shaft revolves, the balls swing outward. The centrifugal force increases with the rate of velocity at which the shaft rotates, hence the balls are caused to swing farther from the axis of rotation. The object is to secure the uniform velocity of the engine, which is done by this arrangement, since the admission of steam is restricted by a valve as the balls swing outward, but is admitted more freely when they swing nearer to the axis of rotation. A similar contrivance is utilized in mills to equalize the motion of machinery. In high-class motors the ball governor is being displaced rapidly by the *inertia governor.* This invention overcomes the objection that a ball governor does not act on the valve until the speed is increased. The inertia governor consists of weights and springs, is set in the flywheel of the engine or motor, and acts by its inertia. When there is a tendency of the speed to increase, the inertia of the weights acts in opposition to this tendency, affects the eccentrics, and through them the valves. By means of this device it is possible to check a tendency to increase speed in less than one revolution of the fly wheel. Other

governors include those which regulate the inflow of gas and water, each class being used for various purposes.

GOVERNOR'S ISLAND, an island in New York Bay. It has an area of 65 acres. Since the War of 1812 it has been occupied by the War Department. Besides containing a number of forts, it is headquarters for the Department of the East. It is the seat of a military museum in which are a number of interesting relics, among them the horse ridden by Sheridan from Winchester, which has been substantially mounted.

GOVERNOR'S ISLAND, an island of Massachusetts, in Boston Harbor, about two miles east of Boston. For government purposes it belongs to Suffolk County. Fort Winthrop, at its northern end, is the principal fortification. The island is occupied by the national government.

GOWAN, James Robert, statesman, born in Ireland in 1815. He came to Canada in 1832 and for some time served as a volunteer in the military forces. In 1838 he was admitted to the bar of Upper Canada and served as judge from 1843 until 1883, when he retired from the bench. He was appointed by the crown as a life member of the Senate in 1885. He was head of the board of public instruction in his district for 27 years, served as chairman of the Barrie Collegiate Institute 36 years, and took a prominent part in revising and codifying the laws of the Dominion. For these and other valuable services he was thanked at different times by the government.

GOWER (gou'ẽr), **John,** poet, born in Yorkshire, England, about 1325; died in 1408. He descended from a wealthy family and was an intimate friend of Chaucer. He spent his declining years in the priory of Saint Saviour's, in South Warwick, where a monument was erected to his honor. His writings treat largely of morals and the metaphysics of love. They include works in French, Latin, and Old English. The titles are "Speculum Meditantis," "Vox Clamantis," and "Balades and Other Poems."

GOZZOLI (göt'sô-lē), **Benozzo,** painter, born near Florence, Italy, in 1420; died about 1498. He studied under Fra Angelico and became a painter of a Florentine school. In 1448 he painted at Rome and subsequently did work in frescoes at Pisa and Orvieto. His most celebrated production is a series of frescoes on the wall of the Campo Santo in Pisa, which consists of scenes from the history of the Old Testament. Among his chief works are "The Story of the Magi," "Life of Noah," "Visit of the Queen of Sheba to Solomon," "Building of the Tower of Babel," "The Rape of Helen," and "The Destruction of Sodom."

GRACCHUS (grăk'kŭs), a famous historical family of Rome, of which two members became specially distinguished as soldiers and statesmen. Tiberius Sempronius Gracchus, born about 168 B. C., accompanied his brother-in-law, Scipio Africanus, to Africa, and in 137 served in Spain as quaestor to Mancinus. He was elected consul in 133 and by his skill secured a reënactment of the agrarian law of Lincinius Stolo, besides reducing military service and effecting other reforms. He was violently opposed by the aristocratic party in the ensuing election, and, after being defeated, this public benefactor was cruelly slain along with many of his friends.

Caius Sempronius Gracchus was a brother of the former. He was born about 159 B. C., and served in Spain under Scipio Africanus at the time of his brother's death. After the first burst of opposition to him had subsided, he returned to Rome and was elected a tribune in 123. He was reëlected the following year, but failed when a candidate the third time. His aim was to better the condition of the poor and to reëstablish the agrarian law, thus receiving the plaudits of the common people. After his failure to return as tribune, these reforms were rapidly repealed by the aristocratic party and soon his life became endangered. More than 3,000 of his supporters were slain, but he escaped to the groves of the Furies with a slave, who, after killing his master, committed suicide. It was not long until the people discovered the error in forsaking their friend and made tardy amends by erecting statues and worshiping the Gracchi as deities. It is related of Cornelia, mother of the Gracchi, that, when a friend asked to see her jewels, she pointed to her two sons and remarked, "These are my jewels."

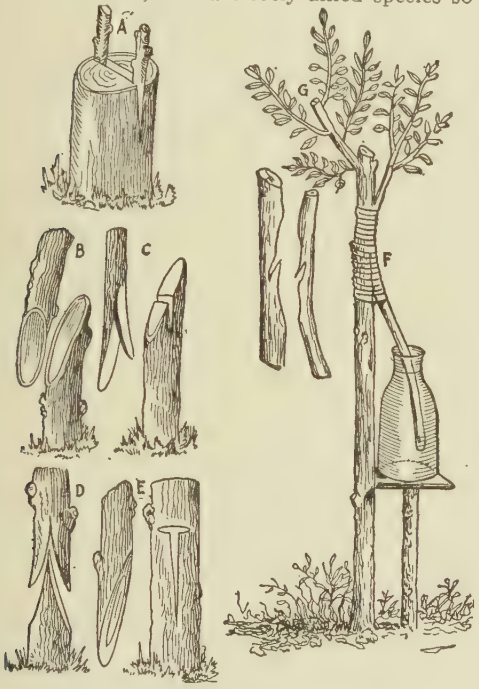
GRACE, Days of, a short period, usually three days, allowed for the payment of a bill of exchange or a promissory note, after the day indicated for payment on the face. In most countries, as in Great Britain and the United States, there are three days of grace, but in some instances the time is longer, varying from three to thirty days. Such an allowance is now almost universal; hence a bill does not become due, either in law or in fact, on the day stipulated, but on the last day of grace. If the last day of grace is a holiday, so the banks are closed, the obligation is due the date preceding the last day of grace.

GRACES, the name applied by the Greeks to the three daughters of Zeus and Eurynome, who personified all those gentler attributes which beautify and refine human existence. The individual names of the three sisters were Euphrosyne, Aglaia, and Thalia. They portrayed every gentle emotion of the human heart, such as friendship, modesty, gentleness, purity of mind, and eternal youth. Elaborate works of art and poetry were dedicated to the Graces, while in statuary they are seen in each other's embrace, or stand with their hands linked to signify their virtues.

GRADY, Henry Woodfin, journalist, born in Athens, Ga., in 1851; died Dec. 23, 1889. He

graduated at the State University of Georgia, took a course at the University of Virginia, and became a southern correspondent for the New York *Herald*. Subsequently he edited the Rome *Daily Commercial*, later the Atlanta *Herald*, and in 1882 became managing editor of the Atlanta *Constitution*, which position he held until his death. His remarkable ability as an orator gave him much popularity. The best of his orations are "The New South" and "The Future of the Negro." A public hospital and a handsome monument were erected in his honor at Atlanta.

GRAFTING (grȧft'ĭng), the process of inserting a scion or bud, taken from a vigorous tree or shrub, into a closely allied species so as



GRAFTING.

A, Cleft grafting; B, splice grafting; C, tongue grafting; D, saddle grafting; E, side grafting; F, scion receiving moisture partly from a vessel; G, part of stock.

to cause them to unite organically and enable the graft to receive greater nutritive power than it could otherwise obtain. Among the advantages of grafting are the rapid multiplication of species, the propagation of particular types which cannot be obtained from seed, and the cultivation of tendencies to bear fruit several years earlier than is otherwise possible. The fruit borne by the graft does not partake of the identical kind common to the stock, but preserves its own peculiarities. Thus, it is possible to propagate several species of fruit or flowers on one stock. This is shown in the illustration, since the scion F receives support in part temporarily from water contained in the vessel, while the twig G is a part of the stock.

The principal methods of grafting are by approach, scions, and buds. In *approach grafting* several parts of two or more plants growing from different stocks are united by bringing the roots, branches, or stems together. To effect this it is necessary to remove equal parts of the bark and unite the wounds by air-tight inclosures of grafting wax, ligature, or clay. *Scion grafting* includes various methods, some of which are known as cleft, side, splice, tongue, saddle, crown, and whip grafting. In all of these forms it is necessary to bring the growing parts into apposition; that is, the edges of the bark must be arranged so the alburnum of both parts will be in close contact. The scion method may be performed both in woody and herbaceous plants, but union takes place only in case the processes of life are freely exercised. *Bud grafting* is practiced largely in fruit trees and roses. It consists of transferring the buds of one plant, along with a small section of the bark, to another plant in which a wound has been made. In all forms of grafting it is necessary to exclude air from the wound. Among the common materials used for this purpose are India rubber, clay, and a mixture of beeswax and tallow. See **Budding.**

GRAFTON (grȧf'tŭn), a town of Massachusetts, in Worcester County, seven miles southeast of Worcester. It is on the Boston and Albany and the New York, New Haven and Hartford railroads, and has a large trade in produce and manufactures. The chief industries include cotton mills, boot and shoe factories, and machine shops. It has electric lights, waterworks, and several fine schools and churches. The first settlement was established by John Eliot in 1660 and the town was incorporated in 1735. Population, 1925, 6,973.

GRAFTON, a city of North Dakota, county seat of Walsh County, forty miles northwest of Grand Forks, on the Northern Pacific and the Great Northern railroads. It is nicely located on the Park River, in a fertile farming district. Among the enterprises are flour mills, stock yards, machine shops, grain elevators, and a creamery. It is the seat of a State institution for the feeble-minded. Population, 1925, 2,913.

GRAFTON, a city in West Virginia, county seat of Taylor County, on the Tygart Valley River. It is on the Baltimore and Ohio Railroad. The surrounding country is lumber and coal producing. Among the noteworthy buildings are the State reform school, which is at Pruntytown, the courthouse, and the high school. Near the city is a national cemetery with 1,265 graves. It has manufactures of railroad cars, machinery, flour, and ironware. Grafton was platted in 1854 and incorporated two years later. The growth of the city is due largely to the machine shops of the Baltimore and Ohio Railroad. Population, 1920, 8,517.

GRAHAM (grā'ȧm), **William Alexander,** statesman, born in Lincoln County, North Caro-

lina, Sept. 5, 1804; died Aug. 11, 1875. He attended the University of North Carolina, was admitted to the bar in 1833, and became a member of the State Legislature. In 1841 he was elected United States Senator as a Whig and subsequently served two terms as Governor of his State. Millard Fillmore appointed him Secretary of the Navy and in 1852 he was the unsuccessful candidate of the Whig party for Vice President. In 1864 he was chosen as a Senator of the Confederate Congress.

GRAHAMLAND, a region discovered in 1832 in the Antarctic Ocean and claimed for Great Britain by Captain Biscoe. It is situated south of 68° south latitude, has an apparently large area, but is snow and ice bound and of little value.

GRAIL, or **Graal, Greal, Grasal,** and **Sangrael,** according to legends, the cup used by Christ at the Last Supper, preserved by Joseph of Arimathea, and by him used to receive some blood of Christ at the crucifixion. An account of this vessel is given in the gospel of Nicodemus, a work not accepted as canonical. Many of the Moorish and Christian remains of early times indicate traces of the tradition and the use of various forms of worship into which a symbolic vessel entered. According to a legend, the Holy Grail, as it became known, was brought to England by Joseph of Arimathea in 63 A. D. Later the vessel was lost because the possessor to whom it had passed committed sin, and a search undertaken for the lost treasure by King Arthur and the Knights of the Round Table became known as the Quest of the Holy Grail. At the capture of Caesarea by the Crusaders, in 1101, a dish made of a single large emerald was found which was regarded as the Holy Grail, and is still preserved at the Cathedral of San Lorenzo in Genoa. The Holy Grail was reputed invisible to persons not pure and holy, and when anyone approached who was unholy the cup vanished. Wagner accords the story of the Holy Grail a prominent place in the opera of "Parsifal" and Tennyson gives it a place in his "Idylls of the King." Lowell's "Vision of Sir Launfal" makes mention of it. The numerous romances and poems found in literature referring to the Holy Grail are of much interest, particularly those of Arthur and the Knights of the Round Table.

GRAIN, a term applied to the common cereals, as growing plants, in gathered condition, or as seeds in bulk. Many of the grains are used in making meal or flour. They include corn, wheat, rye, oats, barley, rice, buckwheat, flax, and cotton. The principal constituents of grain seeds are starch, gluten, sweet mucilage, and an aromatic substance. Among the largest grain fields of the world are those of the Mississippi Valley in North America, the Paraná valley in South America, the Nile valley in Africa, and the valleys of the Po, Volga, and Ganges of Eurasia.

GRAIN ELEVATOR, a building used for elevating, storing, and loading grain for transportation into cars or vessels. Buildings for these purposes are maintained in all the grain-producing districts and in the large cities where the grain market centers. The capacity of grain elevators situated in the trade centers and shipping ports is very large. Some of the larger elevators of Chicago have a capacity of 50,000,000 bushels; New York, 29,000,000 bushels; Minneapolis and Winnepeg, 26,000,000 bushels; Buffalo and Toronto, 15,000,000 bushels; Saint Louis, 15,000,000 bushels; and Toledo, 7,000,000 bushels. The largest elevators in Chicago are 150 feet wide and 550 feet long and have a height of 160 feet. In construction the bins and the buildings were formerly largely of wood, and the outside was encased by a brick or fireproof metallic covering. At present the construction is principally of steel, modeled after the methods of constructing blocks of steel in cities, and thus furnish ample protection against fire. This form of construction provides greater convenience and durability. The newer elevators are built largely of brick and concrete, though the frame and bins are of steel and iron. See **Elevator.**

GRAKLE (grāk'l), or **Grackle,** the name of several birds found in both hemispheres. The name was first given to various birds of the starling family, such as the paradise grakle, which is native to India. These birds are represented in America by the crow blackbird and the rusty grakle. The former is widely distributed, some species of which are known locally as the jackdaw. Most species have a long tail and the male is uniformly glossy black, while the female is gray or brownish. The rusty grakle extends from the eastern part of the United States to the northwestern part of Canada.

GRALLATORES (grăl-lā-tō'rēz), or **Waders,** an order of birds which frequent shores, banks, and marshy places. They have long legs, necks, and beaks, and wade in the shallow water in search of worms and insects. Some of the species dive to obtain food at the bottom of the water. Among the representative birds of this order are the plovers, coots, snipes, curlews, and herons.

GRAM, or **Gramme,** the unit of weight in the metric system. It is intended to be exactly equivalent to the weight in a vacuum of one cubic centimeter of pure water at its maximum density. In comparison with the English system it is equal to 15.432 grains. A gram degree, in physics, is a unit of heat, being the amount of heat necessary to raise the temperature of one gram of pure water one degree centigrade.

GRAMMAR (grăm'mẽr), the science which treats of the principles and usage of language. English grammar is divided into four parts, orthography, etymology, syntax, and prosody. *Orthography* treats of elementary sounds, let-

ers, syllables, and spelling; *etymology,* of the classification, derivation, and properties of words; *syntax,* of the construction of sentences; and *prosody,* of the quality of syllables, of accent, and of the laws of versification. Every language has a grammar peculiar to itself. *Comparative grammar* is based on the study of words, analyzes them, and accounts for the changes they have undergone. It properly embraces a study of the growth of languages. However, comparative grammar is of recent origin. It dates from the development of knowledge of the Sanskrit as associated with the Indo-European group of languages. Among the eminent students of comparative grammar are Grimm, Max Müller, Pott, and Schleicher.

GRAMOPHONE (grăm'ō-fōn), an apparatus to reproduce sound, invented by Emile Berliner. It differs from the phonograph and graphophone in that the record is on a disk instead of a cylinder. The disk contains the record on a rubber surface and the stylus or needle is connected with a diaphram, which travels along a spiral groove as the disc revolves horizontally under the impulse of a spring clockwork. The gramophone is now used quite extensively as a phonograph (q. v.).

GRAMPIANS (grăm'pĭ-ąns), a group of highlands in Scotland, stretching a distance of 150 miles from the northeast to the southwest. The average height is about 2,500 feet, but Ben Macdhui and Ben Nevis, the highest summits of Scotland, have elevations of 4,048 and 4,406 respectively. Beautiful valleys intersect the Grampians. A mountain system in the western part of the province of Victoria, Australia, is known by the same name.,

GRAMPUS (grăm'pŭs), the popular name of a genus of large dolphins. The common grampus differs from the porpoise in having a thicker body. It has no teeth in the upper jaw, only a few teeth in the front part of the lower jaw, and the color is gray with streaks of white. The larger species are about twenty feet long. The common grampus feeds on small fish, squid, and mollusks. The name is applied to nearly all the cetaceans that are too small to be classed with the whales and too large to be grouped with the porpoises.

GRANADA (grą-nä'dą), a former Moorish kingdom of Spain. It had an area of 11,060 square miles, but is now included with the three Mediterranean provinces of Almeria, Granada, and Malaga. Grenada became a separate kingdom in 1225 and was made a part of Spain in 1492. The products of the region are cereals, domestic animals, sugar cane, fruits, and minerals, especially lead and iron. Granada, one of the chief cities, is the capital of the province of Grenada.

GRANADA, a city of southern Spain, capital of the province of Granada and formerly of the Moorish kingdom of Granada. It is situated on the Jenil River, at the foothills of the Sierra Nevada, and occupies a site about 2,000 feet above sea level. Its streets are tortuous, but the houses are well built in the Moorish style. The city is connected by several railroads and within recent years has had a healthful commercial growth. It has manufactures of saltpeter, woolen textiles, gunpowder, silks, and machinery. Among its public institutions are a splendid cathedral, a university, several public parks, and a number of schools and academies. The university was founded in 1531, carries advanced courses of study, and is attended by several hundred students. Granada was founded by the Moors in the 8th century. It became the capital of the Moorish kingdom in 1235, and, when conquered by Ferdinand and Isabella, in 1492, it had a population of nearly 500,000. In 1610 the Moors were expelled from Spain, which caused the city to decline. At present it is surrounded by a strong wall. It still contains the Moorish palace of Alhambra and an unfinished palace commenced by Charles V. Population, 1906, 76,090; in 1920, 77,245.

GRAND ARMY OF THE REPUBLIC, a patriotic society of the United States, founded at Decatur, Ill., on April 6, 1868. The principal object is to promote a feeling of fraternal friendship among the sailors and soldiers who took part in the naval and military forces of the Federal government during the Civil War, to perpetuate the memory and history of the dead, and to extend aid and comfort to the orphans and widows. All the sailors and soldiers who were called into active service between April 12, 1861, and April 9, 1865, and received an honorable discharge, are eligible to membership. The list of eligibles also includes those who were members of State regiments, hence were subject to the Federal officers. Annual encampments are held in the leading cities and meetings of state and territorial departments usually meet each year. The official badge consists of a ribbon showing the national flag, to which is attached the brass star of the membership badge. The membership in 1890 was 409,489, but there has been a constant decrease owing to the annual deaths, which have averaged about 9,000. In 1923 the membership was reported at 84,578.

GRAND JUNCTION, county seat of Mesa County, Colorado, at the confluence of the Grand and Gunnison rivers, in an agricultural region, on the Denver and Rio Grande Western Railroad. It has brickyards, machine shops, iron smelters, railroad shops, and extensive coal interests. The features include the public library, high school, and railway depot. It was incorporated in 1881. Population, 1920, 8,665.

GRAND FORKS, a city in North Dakota, county seat of Grand Forks County, on the Red River of the North, about 75 miles north of Fargo. It is on the Northern Pacific and the Great Northern railroads, and is surrounded by a fertile agricultural country. The noteworthy

buildings include the high school, the county courthouse, the Wesley College, the Federal building, and a number of banks and hotels. Besides being the seat of Saint James Academy, it contains the Lutheran Bible School, and the University of North Dakota. Among the manufactures are farming implements, flour, woolen goods, cigars and machinery. It has electric lights, waterworks, pavements, and other municipal improvements. Grand Forks was settled in 1871 and incorporated in 1881. Population, 1925, 15,186.

GRAND HAVEN, a port city on Lake Michigan, county seat of Ottawa County, Michigan, near the Grand River, about 31 miles west of Grand Rapids. It is on the Père Marquette and the Grand Trunk railroads, and is surrounded by a fertile agricultural and fruit-growing country. The city has a good harbor, two lighthouses, and a large trade in grain and lumber. Among the manufactures are furniture, machinery, canned goods, ironware, and pianos. The fisheries are an important factor in its prosperity. Several steamboat lines furnish regular communication. It is improved by electric lights, waterworks, etc. The chief buildings include the high school, the public library, and the Ackley College for girls. It was first settled in 1835. Population, 1904, 5,239; in 1920, 7,224.

GRAND ISLAND, a city in Nebraska, county seat of Hall County, on the Platte River, 148 miles west of Omaha. It is on the Chicago, Burlington and Quincy, the Union Pacific, and other railroads, and has extensive railway machine shops. The noteworthy buildings include a fine courthouse, the Grand Island College (Baptist), the public library, the Saint Francis Hospital, and the Nebraska Soldiers' and Sailors' Home. It is an important grain and stock shipping center, and manufactures flour, beet sugar, wire fences, brooms, machinery, farming implements, and cigars. It has systems of sewerage, parking, electric lights, waterworks, and telephones. It was settled in 1869 and incorporated in 1872. Population, 1920, 13,960.

GRAND JURY. See **Jury.**

GRAND MANAN (mȧ-năn'), an island of Canada, in Charlotte County, New Brunswick, at the entrance to the Bay of Fundy. It is about twenty miles long and five miles broad and is well timbered. Population, 1921, 2,761.

GRAND MERE, a city of Champlain County, Quebec, on the Canadian Pacific and the Canadian Northern railways. It has paper mills, machine shops, and a large trade in merchandise. The features include street paving, city hall and Saint Peter's church. Water power is obtained from the St. Maurice River. It was incorporated in 1898. Population, 1921, 7,631.

GRAND PRE (grän prȧ), a village of Nova Scotia, in Kings County, on the Dominion Atlantic Railway. It is about fifteen miles from Windsor and is famous in literature as the central theme in Longfellow's "Evangeline." The French settled it in 1604 and it became a British possession in 1713. However, the expulsion of the Acadians did not occur until 1755. Population, 1921, 873.

GRAND RAPIDS, a city and the county seat of Kent County, Michigan, at the head of navigation on the Grand River. It is on the Grand Trunk, the Michigan Central, the Père Marquette, the Pennsylvania, the New York Central, and other railroads, and has communication by a network of electric railways. An abundance of water power is obtained from the rapids in the Grand River. The streets are well paved with brick and asphalt and lighted with gas and electricity. The architecture is generally substantial, including many tall and fireproof buildings. Among the noteworthy structures are the Federal buildings, the county courthouse, the public library, the Masonic Temple, the Pythian Temple, and many public schools and churches. It is the seat of the Michigan Soldiers' Home, Saint John's Orphan Asylum, State Masonic Home, city home for the treatment of contagious diseases, Holland Home, and Isabella Home.

Grand Rapids is important as a manufacturing and jobbing center. It has a large trade in lumber, fruit, grain, quarry products, and merchandise. Among the manufactures are furniture, flour, clothing, machinery, utensils, and hardware. Near the city are gypsum quarries that product an immense quantity of stucco. It has extensive productions of brick and tile. The furniture manufactories rank as the largest in the world. Grand Rapids was settled in 1833 and received its charter as a city in 1850. Population, 1904, 95,718; in 1920, 137,634.

GRAND RAPIDS, a city of Wisconsin, county seat of Wood County, 95 miles west of Green Bay. It is on the Wisconsin River and on the Chicago and Northwestern, the Chicago, Milwaukee and Saint Paul, and other railroads. It has a public library, electric lighting, waterworks, and a growing trade in merchandise and agricultural products. The manufactures include paper and wood pulp, cooperage, flour, machinery, and clothing. It has a number of fine county and school buildings. Centralia was annexed to Grand Rapids in 1900. The name was changed to Wisconsin Rapids in 1920. Population, 1920, 7,243.

GRAND REMONSTRANCE (rē-mŏn'-strans), a document presented by the House of Commons to Charles I. of England in 1641. It was adopted by a majority of 11 votes at a time when the king was absent in Scotland, and consisted of 204 sections in which real or alleged irregularities of the government were enumerated. Among the principal grievances stated were that the government had levied forced loans, practiced excesses in the courts of the Star Chamber, injured the people by building up commercial monopolies, and illegally enlarged the royal forests. The king at first

ignored the manifesto and later issued an evasive reply, but afterward tried to impeach the leaders who promoted it in the House of Commons. This unsatisfactory policy on the part of the king was one of the causes that brought on the Civil War and the establishment of the Commonwealth.

GRAND RIVER, a tributary of the Colorado, rises in Grand Lake, and after a course of 350 miles joins the Green River in Utah to form the Colorado. It flows through a mountainous country in the greater part of its course, and in several localities passes through deep canyons. The Dolores and Gunnison are its chief tributaries.

GRAND RIVER, a river of the United States, rises in Iowa, and after a course of 300 miles flows into the Missouri. Its direction is mainly toward the southeast, entering the Missouri River at Brunswick, Mo. The country through which it flows is highly fertile and in its lower course are valuable forests.

GRANGE (grānj), or **Patrons of Husbandry.** See **Farmers' Organizations.**

GRANITE (grăn'ĭt), an unstratified rock, generally consisting of the three minerals, quartz, mica, and feldspar. The crystal grains of which it is formed vary in size, thus giving rise to the fine-grained and coarse-grained varieties. The latter is commonly called *pegmatite.* The grain crystals range from the size of a pin head to a two-foot cube. Such minerals as beryl, garnet, and tourmaline are found in granite formations, often in small particles scattered through the body. Granite is classed as an igneous or fire-formed rock, and originated under great heat and pressure beneath the surface of the earth, the pressure being produced in most cases by earth, but also by water and steam. It was forced from the pre-Cambrian to the Tertiary ages, the granite of the Alpine region of Europe being of the more recent formation. It is widely distributed and constitutes the most durable material for buildings and monuments. Among the productive granite districts of the United States are those of New England, New York, California, Michigan, and other states. It is quarried extensively in Canada, Italy, Sweden, Switzerland, Russia, and in Africa. The *red granite* of Scotland and the *Barre granite,* a gray species, of New Hampshire, are used extensively in monuments.

Granite varies greatly in hardness and color, according to the proportion of its constituents. The varieties in which feldspar predominates are inclined to crack, hence they do not possess much value for building. The harder species are used for building monuments, bridges, public buildings, and fortresses. Its hardness makes the expense for quarrying and cutting considerable, though this is at least in part overcome by its durability and beauty. Most species take on a fine polish. Those containing considerable feldspar are reddish, the flesh shade of some being due to mica, while others are grayish-blue, gray, yellowish, pinkish, or drab. Among the ancient Egyptians granite was highly prized as building material and for tombs and monuments. Their statues were made largely of Oriental basalt found in the deserts of Egypt.

GRANITE, a city of Madison County, Illinois, on the Mississippi River, 12 miles north of East St. Louis, on the Wabash, Chicago and Alton, Chicago and Eastern Illinois and other railroads. The leading industries include car building, steel and iron works, glucose factory, and machine shops. Among the features are the high school, city hall, federal building, and interurban railways. It was settled in 1894 and incorporated in 1896. Population, 1920, 14,757.

GRANT, Frederick Dent, public man, eldest son of General Grant, born in Saint Louis, Mo., May 30, 1850. In 1871 he graduated from West Point, accompanied General Sherman to Europe the same year, and shortly after was appointed to command the military escort for the Southern Pacific surveyors. He became lieutenant colonel in 1873 and served for eight years on the staff of General Sherman, and shortly after accompanied his father on the trip around the world. President Harrison appointed him United States minister to Austria in 1889, where he served four years, and in 1895 he became a police commissioner of New York City. In 1898 he accepted a command in the Spanish-American War, and subsequently served in the Philippine Islands as brigadier general. He was made brigadier general in the regular army in 1901 and later held commands in Texas and in the East. He died April 12, 1912.

GRANT, George Monro, author and educator, born at Albion Mines, Nova Scotia, Dec. 22, 1835; died in 1902. He studied at Pictou Academy and the West River Seminary, and in 1857 graduated at the University of Glasgow, Scotland. Soon after he returned to Canada and became pastor of a Presbyterian church at Halifax. In 1877 he was chosen principal of Queen's University, Kingston, Ontario. He was a forcible and eloquent orator and did much to promote the union of the Presbyterian churches in the Dominion. His chief writings include "Ocean to Ocean Through Canada," "Our National Objects and Aids," "Advantages of Imperial Federation," and "Religion of the World in Relation to Christianity."

GRANT, James, novelist, born in Edinburgh, Scotland, Aug. 1, 1822; died May 5, 1887. At the age of ten years he was taken to Canada by his father, an officer in the British army, and resided in Newfoundland until 1839, when he returned to England. He left the military service in 1843 and took up literature. In 1846 he published his first novel, "The Romance of War." His writings have been widely read in Canada and the United States. They include "Old and New Edinburgh," "British Battles on Land and Sea," "History of the War in the Sudan,"

"Playing with Fire," "Cavaliers of Fortune," and "Love's Labor Won."

GRANT, Robert, jurist and author, born at Boston, Mass., Jan. 24, 1852. He studied at Harvard University, where he graduated in 1873, and subsequently completed a course at the Harvard Law School. For some time he practiced his profession in Boston and in 1893 became judge in Suffolk County, Massachusetts. His writings include many novels and several essays, some of which have been widely read. The titles include "Reflections of a Married Man," "The Opinions of a Philosopher," "A Romantic Young Lady," "The Knave of Hearts," "Unleavened Bread," and "The Bachelor's Christmas, and Other Stories."

GRANT, Ulysses Simpson, eighteenth President of the United States, born at Point Pleasant, Clermont County, Ohio, April 27, 1822; died July 23, 1885. He descended from a Scotch ancestry that came to America in 1630, his father being Jesse R. Grant. While a boy he worked on the farm and in the tannery of his father, attended the public schools, and when seventeen years old received an appointment to West Point, from which he graduated as brevet second lieutenant in 1843. Soon after he was stationed at Jefferson Barracks, Missouri. In 1846 he entered the service in the Mexican War and took part in all the battles fought by Scott and Taylor, except that at Buena Vista. He declined the honor of being brevetted for gallant conduct at the battles of Palo Alto and Resaca de la Palma, but in 1847 was made brevet first lieutenant for bravery at Molino del Rey.

ULYSSES S. GRANT.

In 1848 he married Julia Dent, the daughter of a Saint Louis merchant, and during the following six years served at various posts, attaining to the rank of captain in 1853. In 1854 he retired from the army and occupied himself in farming near Saint Louis, in which he continued until 1860, and, not finding farming profitable, engaged as clerk in his father's leather business at Galena, Ill. He drilled a body of volunteers at Galena in 1861 and soon entered the service as colonel, and in August of the same year was made brigadier general of volunteers. His first services of great value were in 1862, when he captured Forts Henry and Donelson and fought the Battle of Shiloh. In 1863 he secured victories at Port Gibson and Champion Hill and drove the enemy into Vicksburg, where he commenced a siege in May, and on July 4, 1863, received the surrender of that place with the garrison of 32,000 men. He then became major general, was given command of the military division of the Mississippi and by skillful management drove the Confederates from Tennessee. The rank of lieutenant general was conferred upon him March 9, 1864, and three days later command of all the Union forces was given him. Thus raised into a field of greater latitude, he at once planned to confront the enemy at every important point by aggressive activity with the view of making it impossible for the armies of the Confederates to support each other. Accordingly he took the field in person against Lee in northern Virginia, sent Sigel to penetrate the valley of Virginia, dispatched General Sherman to Georgia, and directed Butler to threaten Richmond.

Grant's operations against Lee were characterized by terrible battles from the time he left the Rapidan, including those of the Wilderness, Spottsylvania, North Anna and Cold Harbor, but he succeeded in causing the enemy to fall back steadily with irreparable losses. To relieve Butler at Bermuda Hundred he crossed the James below Richmond, and thus included Petersburg in the final contest. The campaign from the Rapidan to Appomattox continued from May, 1864, to April, 1865, though the country at times became discouraged and the government advised him to abandon his line of aggression. However, Grant kept steadily on. After the Battle of Spottsylvania, in May, 1864, he sent a dispatch to the government, which closed with these words: "I propose to fight it out on this line if it takes all summer." Early in April, 1865, Richmond was evacuated, Lee retreated to Lynchburg, and on April 9 surrendered to Grant at Appomattox. The great battles fought under General Grant stand among the most formidable in the history of the world, while the nobility of character displayed by him turned many of his opponents into his warmest friends. After the war he had charge of mustering the army out of service and disposing of the enormous stores of the government. In 1866 he submitted a plan to the government for the reorganization of the army, which at once became the basis of army organization. In the same year Congress created the rank of general of the armies, to which position he was appointed, and other honors were bestowed upon him by the grateful public.

The Republican national convention in session at Chicago in May, 1868, nominated General Grant for President on the first call of states. Of the 294 votes cast in the electoral college he received 214 and Horatio Seymour, his opponent, received 80. Four years later he was reëlected, receiving 286 as against 66 that would have been cast for Horace Greeley if he had lived. After the close of his second term he made a tour around the world, and was re-

ceived with marked enthusiasm in the various foreign countries he visited. An effort was made to again nominate him for President in 1880, but it failed. During his administration the Pacific railroads were completed, the Alabama Claims were settled, the national debt was funded, and the Fifteenth amendment was made a part of the Constitution. President Grant was a plain man and possessed much common sense, but was unfortunate in the choice of advisers and lacked skill in public affairs. His reputation is due to his moral and physical courage and military achievements. Toward the latter part of his life he joined others in a banking enterprise in New York City in which all his property was lost. The writing of his "Memoirs" occupied the last year of his life. In March, 1885, Congress placed him on the retired list as general. His death occurred from a cancer at the root of the tongue, after much suffering. The remains were placed in Riverside Park, New York City, where his magnificent tomb overlooks the Hudson River.

GRANVELLA (grän-vĕl'yà), **Antoine Perrenot,** cardinal and statesman, born at Ornans, in Burgundy, Aug. 20, 1517; died Sept. 21, 1586. He studied law at Padua and theology at Louvain and in 1540 became Bishop of Arras. The same year he attended the Diet of Worms at Ratisbon and subsequently took part in the Council of Trent. He became minister of state to Charles V. in 1550 and soon after negotiated the Treaty of Passau and arranged the marriage between Philip II. with Mary of England. Philip II. retained him as minister of state and in 1559 made him chief minister to Margaret of Parma, who had been appointed regent of the Netherlands. His encouragement of the Inquisition and the introduction of a large Spanish army made him extremely unpopular in the Netherlands, where his house was plundered and razed to the ground. However, he remained a favorite of Philip II., who sent him on important missions to Rome and made him president of the supreme council of Italy and Castile. In 1584 he was made Archbishop of Besançon.

GRANVILLE (grăn'vĭl), **George Leveson-Gower,** statesman and second Earl of Granville, born in London, England, May 11, 1815; died March 31, 1891. He studied at Eton and Oxford and in 1836 was elected a member of Parliament as a Liberal and free trader. In 1846 he became a peer and in 1851 succeeded Palmerston in the foreign office, but retired with the Russell ministry. For a number of years he was president of the council and was leader of the Liberals during the temporary retirement of Gladstone. In 1880, when Gladstone was again made premier, Lord Granville once more assumed the office of foreign secretary and was an active supporter of Irish home rule. He promoted the establishment of Afghanistan as a neutral zone, the occupation of Egypt, and the participation of England in the Berlin Congress.

GRAPE, the wine plant or its fruit. It belongs to the genus *Vitis,* is a climbing vine, and has lobed and somewhat hairy leaves. The stock is woody and is supported by strong tendrils. Nearly all the plants have very long and branching stems, from which the outer bark is easily removed. It is thought that the best fruit-bearing plants are native of the region surrounding the Caspian Sea, extending as far west as the Crimea. Several species of wild grape of inferior quality are native to many countries and grow extensively in the forests of America. The cultivated species thrive in the warm and temperate zones. They produce berries in clusters, some of which are seedless, but others have from one to four stony seeds.

The Phoenicians introduced the grape into Europe from Asia, where it has been grown from remote antiquity, and it was brought to America as soon as permanent settlements were made in the new world. Since then many of the native plants have been improved by cultivation and new species originated by mixture with those of Eurasia. The grape plant may

GRAPE VINE.

be propagated by inoculation, cuttings, grafting, and seeds. Grades of sweet wine are made from grapes which are allowed to be left on the vines until overripe, when they contain a larger per cent. of saccharine matter. The wine products of France, Spain, and Germany are noted, while for productiveness and large species few countries exceed South Australia. In many of the warmer climates the wine plant bears twice a year. The application of artificial heat has materially increased the production, though this was not practiced extensively until within the last century. California is the greatest grape-producing State of the United States, and its products now rival those of Germany and France.

Not less than 500 species of grapes are indigenous to North America, but the number cultivated is comparatively small. The plants are usually obtained by cuttings and are set in rows about ten feet apart. In most cases the ground is cultivated in other crops one or two years, after which it is subjected to clean culture and the vines are supported on trellises. Careful trimming is necessary to secure a large yield of good quality. Among the popular species of

grapes grown for the market are the Concord, Catawba, Niagara, Clinton, White Frontignan, Madeira, and Black Prince.

GRAPESHOT, a class of spherical shot put up in stands, generally consisting of three tiers with three shots in each tier. The use of case shot has superseded largely that of grapeshot.

GRAPHITE (grăf'ĭt), a mineral carbon, also called *black lead* and *plumbago.* It is found in the oldest rock formations, occurring in many portions of the Altai Mountains, Germany, and the United States, especially in New York, Pennsylvania, Michigan, Alabama, and California. Extensive deposits are found in Canada, notably in the Laurentian rocks at Brougham, Bohemia, and Ceylon. It occurs in masses or beds, having a chemical composition similar to anthracite coal, and may be made artificially from coal. The marketable grades have a highly metallic luster, a granular texture, and an iron-gray color. They are soft to the touch and quite unchangeable in the air. Graphite may be heated in a closed vessel without effecting a change. Its use is largely for crucibles, portable furnaces, and pencils. It is employed in electrotyping, for protecting iron from rust, and various other purposes in the arts and industries. The manufacturing establishment founded at Stein, Germany, by A. W. Faber is one of the oldest and largest in the world engaged in the manufacture of pencils. In making pencils the larger blocks of pure graphite are utilized in their natural state by cutting them into pieces and forms of proper size, while the cheaper grades of pencils contain graphite secured by grinding the smaller particles of powder and purifying them by washing, and afterward drying and pressing into proper forms. The harder varieties of graphite pencils are made by adding a small quantity of clay.

GRAPHOPHONE (grăf'ō-fōn). See **Phonograph.**

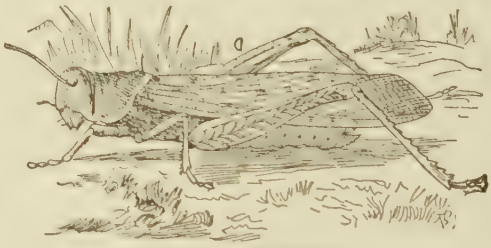
GRASS (grăs), an important and extensive order of endogenous plants, including about 450 genera and 4,500 species. They are distinguished from sedges by their generally cylindrical, pointed, and hollow stems, while sedges are largely triangular in shape, pointed, but solid. There are two classes of grasses, *artificial* and *natural.* The former include such cultivated plants as trefoils, sainfoin, and clover grown for fodder, and the latter embrace the grasses proper. Both of these are of incalculable value on account of the nutritious herbage furnished for stock and the various textiles employed in manufacturing. The soil is enriched by the decaying substances of grasses, and washing away of the surface soil by rains is hindered largely by their roots. Many of the grasses are annuals, but those growing in forests and many having woody structure are not. Different species are commonly found on hills, slopes, valleys, and marshes, and the quality of the soil is often indicated by the kind of grass it bears. The growth in a single season varies from minute forms to heights of fully one hundred feet. Bamboo grasses are woody, while grains rank with the herbs. The different cereals and their products, such as beer, paper, sugar, rum, medicine, bread, and starch, are treated in separate articles.

GRASS CLOTH, the name of certain beautiful fabrics manufactured from ramie, or China grass. The name is somewhat misleading, since the fibers from which the product is made do not belong to the grasses, and the kinds of cloth made from the fiber of true grasses are very coarse. Some varieties of cloth made from ramie resemble silk in fineness and luster and are extremely durable.

GRASSHOPPER (grăs'hŏp-pĕr), an order of insects characterized by large, strong hind legs fitted for leaping. They are allied to the

GRASSHOPPERS.

A, A, A, Adults depositing eggs; *B,* eggs; *C,* group of eggs



ADULT GRASSHOPPER.

locusts, crickets, and cockroaches. Distinguishing and characteristic sounds are produced, as in the locust, by rubbing the wings and wing covers together during flight, and others by rubbing the serrated hind legs against the wing covers, while the peculiar sounds of the katydid and cricket are caused by rubbing one wing cover on the other. The common grasshoppers have long, threadlike antennae and the wings are folded together like the sides of a roof. In some species they are rudimentary and usually are grayish or green in color. They are numerous in all parts of the world, often occurring in such numbers as to be destructive to vegetation. In some of the arid regions, as in western Kansas and Nebraska, they have been known to obscure the sun for hours in their flight, and, when alighting, to be so numerous

(Opp. 1182) INSECTS.

1. Giant Bee (Euglossa dimidiata); 2. Hornet; 3. Bee (Chrysantheda dentata); 4. Cricket; 5. Giant Wasp; 6. Grasshopper; 7. Beetle; 8. Mantis.

as to greatly damage the growing crops. Some species are said to live on insects, but the greater number feed on grass and herbage.

GRASS TREE, the common name of tree-like plants native to Tasmania and Australia, so called from the grasslike foliage. Six species have been described, all of which have upright stems with tufts of long narrow foliage at the upper part, and clusters of flowers are borne amid the tufts of leaves. The bases of the inner leaves are edible and are prepared for the table by roasting. A balsamic gum useful in medicine is obtained from the stem by incisions. The stem rarely reaches a height of more than six feet, though usually it is about four feet high, and the diameter is sometimes a foot.

GRASS VALLEY, a city of California, in Nevada County, 68 miles northeast of Sacramento, on the Nevada County Railroad. It is surrounded by a rich gold-mining region. The industries include quartz mills, machine shops, and marble works. It is the seat of Saint Mary's Academy, has electric lights and a public library, and is the center of a growing trade in merchandise and manufactures. The first settlement on its site was made in 1849. Population, 1900, 4,719; in 1920, 4,006.

GRATIAN (grā'shĭ-ạn), **Gratianus Augustus,** Emperor of Rome, son of Valentinian I., born in 359; died in 383 A. D. He succeeded his father on the imperial throne in 375 as Emperor of the West, while Valens, his uncle, reigned in the East until 378. In the latter year he succeeded Valens, but gave the dominion of the East to Theodosius I. He became unpopular by severely persecuting the pagans and heretic Christians, and through fondness for amusement caused the army to revolt. The military forces in Britain proclaimed Maximus emperor. Gratian was defeated near Paris and fled to Lyons, where he was captured and killed.

GRATTAN (grăt'ạn), **Henry,** orator and statesman, born in Dublin, Ireland, July 3, 1746; died June 4, 1820. He entered Trinity College when seventeen years old and began the study of law at Middle Temple, London, in 1767. He was admitted to the bar in 1772 and elected to the Parliament of Ireland in 1775. In the capacity of legislator he took an efficient part for the reform of the civil service and the improvement of commercial interests. In 1780 he entered upon a plan to separate Ireland from England, for which purpose he moved resolutions, and in 1782 led a revolutionary movement which resulted in Irish independence. A gift of $250,000 was voted him by the Irish Parliament, and other distinctions were accorded him for his public services. Subsequently he opposed the union proposed in 1800 and, when Pitt's measure was passed, he became a member of the imperial Parliament. In 1806 he was elected for Dublin and again advocated the former cause of Irish independence. His last effort to bring about the freedom of his country was made in 1820, but his death occurred before material results were effected. Grattan is noted for his interest in the Irish cause, powerful oratory, and masterly ability to enthuse the people. He was buried in Westminster Abbey, where a tombstone marks his place of burial.

GRATZ (grăts), or **Graz,** a city in Austria, capital of Styria, on the Mur River, about ninety miles southwest of Vienna. The site of the city is a beautiful eminence about 400 feet above the river, the streets are well improved, and important railroad connections facilitate commercial enterprise. Besides a well-organized school system, it has a university founded in 1586 which is attended by 1,725 students and has a library of 90,000 volumes. Other noteworthy buildings are the Gothic cathedral, founded in 1456 by Frederick III., a Gothic church, numerous monasteries, several government buildings, and many splendid residences. The manufactures include silk, woolen, and cotton goods, machinery, ironware, vehicles, soap, sugar, railroad cars, wine, and candles. It has electric lights and street railways, waterworks, pavements, several public parks, and many fine monuments. Gratz was founded in the 12th century. The Hungarians made an attack upon it in 1481, but they were repulsed. It was captured by the French in 1797 and in 1809. The building of railways and the development of manufactures since 1860 has caused it to grow rapidly. Population, 1920, 151,668.

GRAVEL (grăv'ĕl), the general name of small stones or pebbles mixed with sand, loam, or clay. It is formed by the action of water disintegrating rocks, the particles appearing first as bowlders, but later are worn down to pebbles, sand, and even silt. Gravel forms useful material in building highways and ballasting railroad grades.

GRAVELOTTE (grăv-lŏt'), a village in Lorraine, about eight miles west of Metz, France. It is noted as the scene of a severe battle on August 18, 1870, between the Germans and the French. The German army consisted of 211,000 men under the personal direction of King William of Prussia, and the French army of 140,000 was under Marshal Bazaine. The German losses were 20,000 and the French 13,000, but the army of the latter was compelled to retreat to Metz, where the whole force surrendered to Prince Frederick Charles.

GRAVITATION (grăv-ĭ-tā'shŭn), the force with which all heavenly bodies attract each other, often called the attraction of gravitation. That heavenly bodies attract each other was believed by Democritus and Epicurus and later by Bacon, Galileo, and Kepler, but it was left for Newton to discover the universality of gravitation and the law of its action between all bodies. The law he announced is that every

particle of matter in the universe attracts every other particle of matter with a force directly proportional to its quantity of matter, decreasing as the square of the distance increases. In all heavenly bodies two opposing forces are constantly at work, one an attractive and the other a projectile force. If the attraction of gravitation alone operated, all planets would fall into the sun; or, if the projectile force alone existed, all planets would go off into space and move in a straight line forever, unless ultimately brought to rest by some external agency.

The two forces of gravitation are so nicely balanced that all heavenly bodies move around the central luminary with an exact precision, and when a planet is nearest the sun its projectile force is increased to exactly balance the increased force of attraction. Not only are the planets attracted by the sun, but they attract the sun. Their revolution is not properly around the sun, but all heavenly bodies, including the sun, revolve around the center of gravitation, which is a point at or near the center of the sun. The same law operates in the case of all the satellites and primary bodies; they all attract each other directly as their respective masses, and inversely as the square of their distance. The laws of gravitation are well known, but why interposed substances will not interrupt gravitational tendencies, and how it can act at a distance without contact or connection, are problems not yet fathomed.

GRAVITY (grăv'ĭ-tȳ), the natural force exerted on all terrestrial matter, by which all bodies have a tendency to fall toward the center of the earth. This attraction holds all objects, as rock, water, animals, air, buildings, metals, and wood, and from it they receive the property called *weight.* The term *specific gravity* has reference to the relative weight or density of substances. If gravity did not exist, all objects loose on the earth's surface would be inclined to pass off into space by themselves. It is greatest at the surface of the earth, and diminishes as one goes upward, being a thousandth part less on a mountain 10,000 feet high. It is exerted alike on all bodies of equal density, and remains constant at a given place. At the poles its influence is greatest and it gradually decreases toward the Equator. Tests with spring balances have demonstrated that bodies appear to become heavier as we proceed toward the poles. This is due to the centrifugal force caused by the revolution of the earth upon its axis, which is greatest at the Equator and has a tendency to throw bodies off the earth. The difference in weight is $\frac{1}{194}$, or a body weighing 194 pounds at the Equator weighs 195 pounds at the poles. From this is learned that if the earth turned seventeen times faster upon its axis than it does, gravity would be overcome, and bodies would lose the property of weight. Gravity is measured by the acceleration of a falling body and by an oscillating pendulum. Increase in the weight of a falling body on the line between Canada and the United States is about 50.2 feet per second, and the variation of acceleration in different places determines the gravity. A pendulum oscillating once a second at sea level in the latitude of New York, moves slower or faster at places having greater or less gravity, hence it must be shorter or longer respectively to oscillate the same number of times. All heavenly bodies have gravity, the intensity of which is modified by their volume, density, velocity, and the attraction of gravitation.

GRAY, Asa, eminent botanist, born in Paris, N. Y., Nov. 18, 1810; died Jan. 30, 1888. He graduated at the Fairfield College of Physicians and Surgeons in 1831 and taught natural history in the schools of Utica until 1833, when he became assistant at the College of Physicians and Surgeons in New York City. Soon after he began to write on natural science and in 1838 published his first work in botany, entitled "Flora of North America." In 1834 he became botanist of the United States, made an exploring expedition to the islands of the South Pacific, and prepared the "Botany of the Wilkes Expedition." After studying a year in Europe, he accepted a chair in the University of Michigan in 1837, and in 1842 became professor of natural history at Harvard University. In 1873 he resigned at Harvard to succeed Agassiz as regent of the Smithsonian Institution, and four years later was elected a member of the French Academy of Sciences. The last fifteen years of his life were devoted to study and writing in Cambridge, Mass. Gray was a personal friend of Darwin, and accepted the modern theory of evolution published by that writer, but did not reject the tenets of Christianity. As a botanist he ranks among the leaders of the age, was a successful teacher of that science, and was among the first to classify American species of plants in accordance with the natural system. Among his important writings not named above are "Botany of the Northern United States," "How Plants Grow," "Relation of the Japanese Flora to That of North America," "Darwiniana," and "Genera of Plants in the United States." For a period of 35 years he was an editorial writer of the *American Journal of Science and Art.* Gray's Peak in the Rocky Mountains was named in his memory.

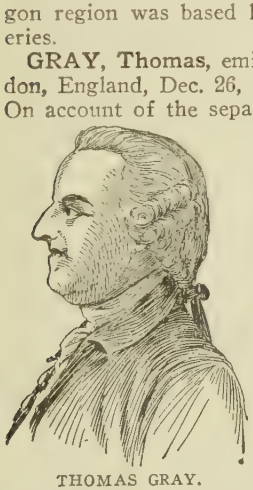
GRAY, Elisha, inventor, born in Barnesville, Ohio, Aug. 20, 1835; died Jan. 21, 1901. He was a successful apprentice to a blacksmith and a carpenter, whereby he provided the means to enable him to take a course of study in physical science at Oberlin College. In 1867 he was granted a patent for a useful telegraphic apparatus, and subsequently he took out about fifty patents, most of which cover inventions or improvements relating to the telephone and to telegraphic instruments. His specifications of the speaking telephone were filed in 1876, but

Alexander Graham Bell received the patent and later the Supreme Court decided against Mr. Gray. His principal inventions include a system of multiplex telegraphy, the telautograph, and the type-printing telegraph. By his multiplex telegraph eight messages can be sent at one time over the same wire, and his telautograph makes it possible to send auto messages by electricity. He published "Experimental Researches in Electro-Harmonic Telegraphy and Telephony."

GRAY, George, jurist and statesman, born in Newcastle, Del., May 4, 1840. He studied at Princeton and Harvard and in 1863 was admitted to the bar. For some time he practiced at Newcastle and Wilmington, and in 1879 was elected attorney-general of Delaware, serving until 1885, when he was chosen as a Democrat to the United States Senate, as the successor of Thomas F. Bayard. He was reëlected in 1887 and in 1893, and was a supporter of the tariff and civil-service reform. In 1900 he was made a member of the international commission of arbitration, and two years later served as chairman of the anthracite coal strike commission.

GRAY, Robert, navigator, born at Tiverton, R. I., in 1757; died in 1806. He saw active service during the American Revolution, and entered the merchant marine after the close of the war. In 1787 he made a trading expedition to the northwestern coast of America, whence he sailed to China, and returned to America by way of the Cape of Good Hope. He made a second voyage to the northwestern coast of America in 1792, when he discovered the Columbia River. The American claim to the Oregon region was based largely upon his discoveries.

GRAY, Thomas, eminent poet, born in London, England, Dec. 26, 1716; died July 30, 1771. On account of the separation of his parents he was brought up by his mother and sister, and was educated at Eton and Cambridge. While at Eton he met Horace Walpole, son of the prime minister, and won his firm friendship. As a student he was mild and melancholy, manifesting a pronounced aversion to mathematics. After studying four years he accompanied Walpole on a tour through France and Italy, and later returned to Cambridge to secure a degree in civil law, where he took up his permanent residence. It was his habit to make notes wherever he went, observing minutely all the natural scenery, and to detail carefully matters of interest to his literary friends. His "Ode to Eton College" was written in 1742, and two years later followed his "Elegy in a Country Churchyard," though the latter was not published until 1751. It is doubtful whether any English poem has had a wider reading than the "Elegy," which maintains an ever-abiding interest. In 1757 he was offered the laurel and emoluments of poet laureate, but he declined to accept it. He became a professor of modern history at Cambridge in 1768 and, though a laborious student and among the most learned of men, his work in this capacity was not highly successful. Personally Gray was popular and enjoyed many warm friends. His spirits were often depressed, verging on despondency, and his writing and speaking were deliberate and slow. The literary treasures he bequeathed to the world are few in number, but take high rank. His principal productions, besides those already named, are "The Bard," "On the Progress of Poesy," "Pindaric Odes," "Fatal Sisters," and "Descent of Odin." His letters and poems in Latin are admirable and surpassed by few.



THOMAS GRAY.

GRAYLING (grā'lĭng), the name of a genus of edible fish, resembling in habits and external appearance the small salmon. The body is slender, the head is somewhat elongated, and the mouth is small. It is active and considered a good game fish. The flesh is highly prized for table use. Two species are widely distributed in North America. These include the *arctic grayling* of Canada and Alaska, which is about eighteen inches long and weighs from one to two pounds. The other species, generally known as the *Michigan grayling,* is found in various parts of the United States, but especially in Michigan and the head streams of the Missouri River. The European species are abundant in the northern part of that continent and extend as far south as northern Italy.

GREAT BARRINGTON, a town of Massachusetts, in Berkshire County, forty miles west of Holyoke, on the New York, New Haven and Hartford Railroad. It is surrounded by picturesque scenery, hence is popular as a summer resort. The manufactures include cotton goods, machinery, paper, and electrical apparatus. It has electric lights, a public library, and waterworks, and is rich in Revolutionary history. In 1786, during Shay's Rebellion, it was the scene of an insurrection. William Cullen Bryant was the town clerk of Great Barrington for several years. It was settled in 1725, but formed a part of Sheffield until 1761, when it was incorporated. Population, 1925, 6,405.

GREAT BASIN, a vast triangular plateau between the Wasatch and Sierra Nevada mountains. It includes nearly all of Nevada and part of Idaho, Oregon, and California. Its length from north to south is 800 miles, and its breadth in a line crossing Great Salt Lake equals about 500 miles. The surface is diversified by valleys and mountains, among which numerous streams and salt lakes abound, but none has an outlet to

the sea. In early geologic times the basin formed a vast lake.

GREAT BEAR LAKE, a large fresh-water lake in the western part of North America, situated in the district of Mackenzie, Canada. Its coast line is irregular and, being crossed by the Arctic Circle, its waters are frozen half of the year. Keith and McVicar bays are the principal coast indentations. The surface area is 14,000 square miles and the elevation above the sea is about 225 feet. It discharges into the Mackenzie by the Great Bear River.

GREAT BRITAIN, the English Empire, including the British Isles and extensive colonial possessions, and known officially as the United Kingdom of Great Britain and Ireland. The British Isles embrace two principal islands, the most important of Europe, the largest of which contains the three political divisions of England, Scotland, and Wales, and the smaller, Ireland. Five groups of islands are included, of which the Scilly and Channel islands belong properly to England, and the Orkney, Hebrides, and Shetland islands, to Scotland. Other islands adjacent and belonging to Great Britain include Wight, Man, and Anglesey. The eastern boundary of the British Isles is formed by the North Sea; the southern, by the Strait of Dover and the English Channel; and the western and northern, by the Atlantic Ocean. Ireland is separated from the larger island by the North Channel, Irish Sea, and Saint George's Channel. The area of the British Isles is 130,979 square miles. It has a coast line, including indentations, of about 4,000 miles.

Surface. The surface is greatly diversified, being mountainous and rugged in the northern portion, especially in Scotland, while the southern part consists of undulating plains. Immense bogs characterize the interior of Ireland, but its coastal regions are fertile and of moderate elevation. The most elevated peaks of Scotland are the Grampians, which attain to heights of about 4,410 feet. In Wales the highest elevation is Snowdon, 3,375 feet, and the most elevated in Ireland is Carrantual, 3,414 feet. The mountain regions extend from Scotland and Wales into England and culminate in Scafell, 3,210 feet. On the border between England and Scotland are the Cheviot Hills, separated from the Pennine Chain by a low strip of country, but a larger part lies in Scotland. These highlands enabled Scotland to maintain a separate political existence for many years, and transportation lines are still mainly around the ends, where they are lowest.

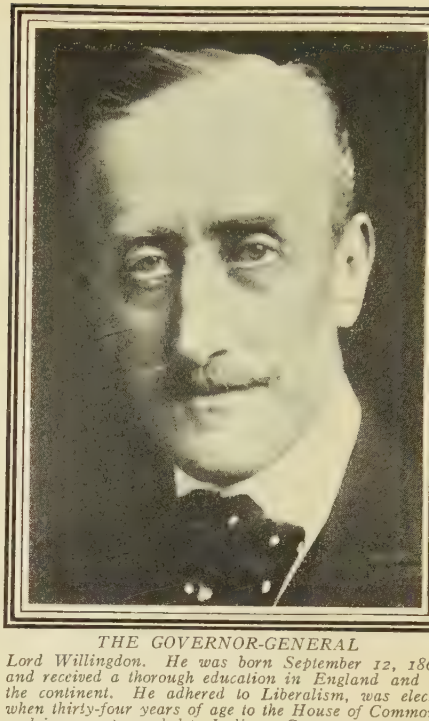
Rivers. Numerous rivers and lakes furnish ample interior water surface for navigation, fisheries, and facilities to propel machinery and supply cities with water. However, the rivers are not of great length and volume, owing to numerous mountains and the comparatively small extent of the surface. The Clyde and the Severn are the two longest rivers, the former in Scotland and the latter in England. The Clyde has been greatly improved by widening and deepening and is an important avenue of commerce. Next to the Severn, which is nearly 250 miles long, is the Thames, about 200 miles, among the river systems of England. Both have sluggish currents and are benefited for navigation by the tides. The Thames is one of the most important avenues of commerce in the world, estimated on the basis of the volume transported. Other streams of importance include the Don, Tay, Dee, Spey, Forth, Trent, and Tweed. In the northwestern part of England is the Lake District of the Cumbrian Mountains, and a famous lake region is in the Highlands of Scotland. Among the lakes of the latter are included Loch Katrine, Loch Lomond and Loch Rannoch.

Climate. The climate as a whole is healthful. The summers are cool and the winters are moderately cold, while the rainfall is quite large. These characteristics are due to the proximity of the sea, since the location in latitude is about that of the Gulf of Saint Lawrence in North America. The harbors do not become ice bound at any time of the year and snowfalls are rare, except in the higher altitudes, but none of the mountains are covered with snow in the summer. In winter the average temperature is about 25° and in summer it is about 60°, while the annual average may be placed at 48°. Clouds are very frequent and the land is covered with fogs quite often. The inland and the western part have the heaviest rainfall, but the annual average for the country is about 40 inches. It is much greater in Wales, where it reaches 60 inches. As a whole the climate of the British Isles is favorably modified by the Gulf Stream, which sweeps across the Atlantic Ocean from North America, and by the prevailing southwest winds. These causes combine to render it equable and highly salubrious.

Industries. The wealth of Great Britain originated from extensive agricultural and mining interests, and upon these were built vast manufacturing enterprises. By aid of an extensive marine it was possible to open the channels of commerce for the exchange of products and the increase in the output of manufactories. All the available land fit for cultivation is utilized with much care and the fertility is maintained by a high state of cultivation and by the use of fertilizers. All the domestic animals common to North America are grown successfully, especially milch cows, dairying being an important enterprise. The agricultural products were nearly sufficient for the food supply of the people until the middle of the 19th century, but with the advent of steam power and improvement in machinery the demand for raw materials rapidly increased and the cost of foreign foodstuffs was cheapened. For these reasons it became impossible to compete longer with grain grown in foreign countries, and thousands of

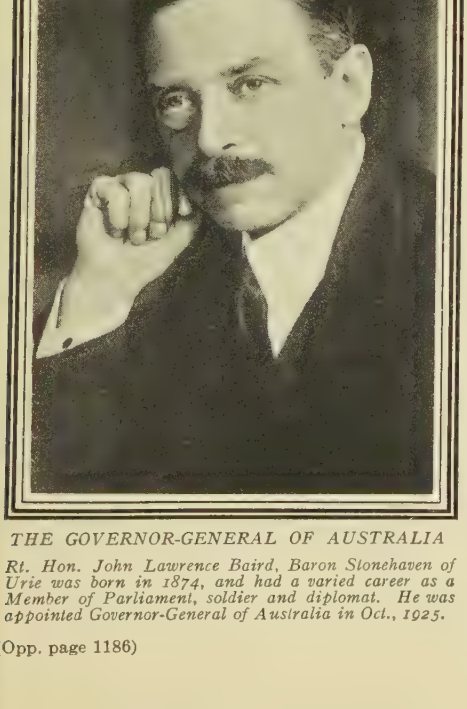
QUEEN VICTORIA

Queen Victoria succeeded to the throne in 1837, at the age of eighteen years. She died January 22, 1901, after the longest reign (63 years) of any English sovereign.



THE GOVERNOR-GENERAL

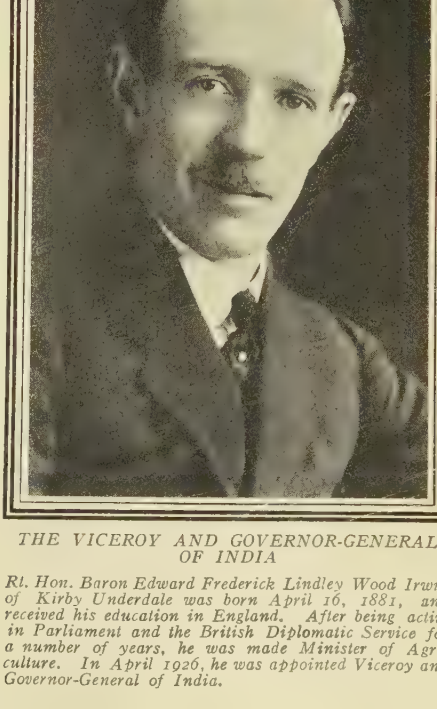
Lord Willingdon. He was born September 12, 18[illegible] and received a thorough education in England and the continent. He adhered to Liberalism, was elec[illegible] when thirty-four years of age to the House of Commo[illegible] and in 1913 proceeded to India as Governor of Bomb[illegible] returning home in 1924. He was appointed Govern[illegible] General of Canada in 1926, and took up the duties [illegible] that high office with dignity and assurance of ent[illegible] success.



THE GOVERNOR-GENERAL OF AUSTRALIA

Rt. Hon. John Lawrence Baird, Baron Stonehaven of Urie was born in 1874, and had a varied career as a Member of Parliament, soldier and diplomat. He was appointed Governor-General of Australia in Oct., 1925.

(Opp. page 1186)



THE VICEROY AND GOVERNOR-GENERAL OF INDIA

Rt. Hon. Baron Edward Frederick Lindley Wood Irwi[illegible] of Kirby Underdale was born April 16, 1881, an[illegible] received his education in England. After being acti[illegible] in Parliament and the British Diplomatic Service fo[illegible] a number of years, he was made Minister of Agr[illegible] culture. In April 1926, he was appointed Viceroy an[illegible] Governor-General of India.

agricultural laborers left the farms and sought employment in the manufactories. Great Britain at present exceeds all countries in the importation of food products and the supply grown at home is far short of the requirement.

Commercially Great Britain holds an important position among the nations. On the one hand it is the largest importer of food products, and on the other hand exports a vast quantity of manufactured articles. The total imports received annually are valued at $3,650,000,000, of which about one-half is paid for articles of food and drink, and the bulk of the balance is expended for raw material for shipyards and factories. At present the domestic exports aggregate about three-fifths of that of imports and nearly all of this represents manufactured or partly manufactured articles. The manufacture of cotton, woolen, linen, and silk textiles have been renowned for many centuries. Its productions of tinware, ironware, machinery, glass, furniture, porcelain, and other useful commodities take high rank among the products of the world. It not only holds a high place among the most important manufacturing nations, but in the production of merchant-marine vessels and general shipbuilding it occupies first place. The annual output of vessels is about 750, with a tonnage of 1,850,000.

Great Britain possessed good transportation facilities long before the advent of the era of railroad building. None of the manufacturing or commercial centers is far from the sea, not more than 75 miles, and all of the cities that have a large trade are near rivers or canals. The Thames River was improved by the government as early as 1423, and the vast network of main and auxiliary canals now in use aggregate a length of about 3,250 miles. The Manchester Ship Canal, 35 miles in length, is one of the most important waterways for large ocean vessels. Many of the rivers, such as the Severn, Thames, and Clyde, have been canalized. The railroads are exceptionally well built and equipped and include a total of 23,500 miles, exclusive of the lines operated in Ireland. With the exception of the United States and Germany, no country of the world has risen to the high development in commerce enjoyed by Great Britain. The import trade, based on values, in the order of importance, is with the United States, France, Germany, Holland, Russia, Belgium, Spain, and Denmark. The exports are largely to the colonies, though it has a large export trade with France, Germany, and Brazil.

Education and Religion. Educationally the British Isles take a high rank, though the per cent. of illiteracy is much greater than in Germany and the Scandinavian countries. Until 1870 education was voluntary, but in that year measures to promote elementary education were passed, and soon after attendance was made compulsory for all children between the ages of five and fourteen. A school attendance law for Scotland was enacted in 1872, by whose terms attendance was made compulsory from five to fourteen years. The Board of Education created in 1899 has charge of educational affairs in England and Wales, but in the latter division the instruction includes a department in the Welsh language. Schools are maintained generally by taxation and public grants. Support is given by the government to many industrial institutes which teach agriculture, dairying, commerce, mining, and the fine arts. In Ireland the educational status is not as well advanced as in the other portions, but a spirit in favor of progressive teaching and for greater educational advancement is becoming more marked.

Among the higher institutions of Great Britain are the universities at Cambridge and Oxford, which rank among the most celebrated of Europe. Other universities in England include those at Liverpool, Manchester, Sheffield, Birmingham, London, and Leeds. The University of Dublin is the most noted in Ireland, and the four celebrated institutions of Scotland are at Glasgow, Aberdeen, Edinburgh, and Saint Andrews. Besides these, there are about ninety colleges in the British Isles, which are supported partly by public grants, but mostly by private and religious societies. All forms of religious worship are tolerated. However, in England and Wales the Protestant Episcopal and in Scotland the Presbyterian churches are favored by state endowments. In this portion of the British Isles the people are largely Protestants, while in Ireland about two-thirds belong to the Roman Catholic Church. Among the numerically strongest Protestant sects in Ireland are the Presbyterian, Methodist, Independents, Baptist, and Friends.

Government. The government is a constitutional monarchy. It was gradually developed from the feudal period to a popular form. The two leading features, which are an administrative ministry and representation of the people in the legislature of two houses, have been adopted by many of the republics of the world. However, the constitution is unwritten and consists of important manifestoes and treaties, royal decrees relating to adminstration, and numerous precedents and judicial decisions. The *Magna Charta* of 1215, the Declaration of Rights in 1689, the Act of Settlement in 1771, the Act of Union with Scotland in 1777, and the Act of Union with Ireland in 1800 are the most important of the constitutional instruments. Nominally the executive power is vested in the king or queen and the two houses of Parliament, but it is actually exercised by a committee of ministers known as the *Cabinet*. The Parliament has supreme legislative power, and the laws made by that body are administered through the Cabinet. Since the cabinet officers are dependent largely upon Parliament and the latter body may name the sovereign when the question of succession arises, it is apparent that the principal

governmental powers in the kingdom ultimately are vested in the Parliament.

Succession to the crown is vested in the eldest child of the preceding ruler and male heirs are preferred over female heirs. At the age of eighteen the heir apparent comes into possession of his title, being Duke of Cornwall by heredity and Prince of Wales by grant. The Protestant Episcopal church being official, it is required that the heir and crown affiliate with it. The sovereign is the nominal head of the Church, presides over the highest ecclesiastical bodies, may grant pardons and issue passports, has power to declare war and make treaties, is the commander of the navy and army, and may appoint and remove certain administrative officers. It is within his range of power to summon, open, prorogue, and dissolve Parliament, but the last mentioned function is not exercised without the advice of the ministry. Though he has the veto power in legislation of Parliament, this right has not been exercised since 1707.

When a new Cabinet is to be chosen, the sovereign selects the leader of the majority party in the House of Commons as Premier, who, after holding consultations with the members of his party, selects a ministry. The ministers chosen by the Premier are appointed by the sovereign, and they may be members of either house of Parliament. They not only retain their seats in Parliament, but as ministers propose many subjects for legislation and are leaders in the debate. Twenty ministers make up the Cabinet, but all of them are not directly engaged in the work of council. When a majority of Parliament become dissatisfied with the action of the Cabinet, they declare that the ministry no longer has their confidence, and they must either change their course in deference to the wishes of the majority or resign.

The legislative functions of the government are exercised by the two houses of Parliament, the House of Lords and the House of Commons. The *Great Council,* as the Parliament was originally called, was first a gathering of nobles and bishops, but in 1265 the commoners were given representation. Edward I., in 1295, issued writs ordering the election of two citizens from each city or borough and two knights from each county. In the 14th century the Parliament was divided into the two houses, and this arrangement has continued up to the present. The lords hold their seats by hereditary right; by virtue of office, as bishops of the Established Church; by creation of the sovereign; by election for the duration of Parliament, as in the case of Scottish peers; or by election for life as in the case of Irish peers. In 1925 the number of names on the roll of lords was 740. Power to revise all bills that come from the House of Commons, except those relating to public revenue and expenditure, is vested in the House of Lords. The expenditures of the nation are controlled by the lower house. All the members of the House of Commons are chosen by qualified electors. The right to vote is restricted to all citizens who are twenty-one years of age or over, and no distinction is made in regard to sex. The total membership of the commons is 670 members, being one representative for each 54,000 inhabitants, and a few of the towns and the great universities have representation. Women are permitted to vote and hold office, their rights being equal to those of men, and they fill many positions of trust in the administration, especially in local and municipal offices and in the affairs of education.

Great Britain being one of the largest political powers in the world, necessarily has vast interests in different lines of government, both local and colonial. Local government is administered in six distinct lines, including those of parishes, rural districts, urban districts, school districts, boroughs, and counties. In these administrative districts the government is vested very largely in the people themselves, subject only to the law and constitution of the nation. Wales has been governed as a part of England since 1536, and the privileges of its inhabitants are coextensive with those of other English subjects. Scotland is represented in Parliament by 16 peers and 72 commoners, and the administration is through the Chief Secretary for Scotland. Local government is similar to that of England, but there is a separate system of civil and criminal courts, though the House of Lords is the highest judicial tribunal to which appeals may be taken. Ireland, since 1921, is governed as two separate states, known as North Ireland and the Irish Free State. The former is under a governor and the latter under a governor general, both appointed by the British crown. Each of these divisions is represented in the British Parliament and both have parliaments of their own. Here the local government conforms quite generally to that of England, and the system of courts culminates in the supreme court of judicature, from which appeals may be taken to the British House of Lords.

The colonies are divided into four classes, depending upon the system under which government is administered. Those of the first class include the possessions that are practically independent of the mother country, such as Canada and Australia; those of the second class are semiindependent, where the legislature is partly elected by the people and partly appointed by representatives of the crown, such as Ceylon and Malta; those of the third class are known as crown colonies and are governed by a council and governor appointed by the crown, such as British Honduras and the empire of India; and those of the fourth class embrace the protectorates, in which native agencies conduct the government. To these may be added a fifth class in which the government is administered by charters through trading companies. Egypt was in a class by itself, where the influence of Great

Britain was paramount, but the government since 1922 is independent of Great Britain.

Great Britain has the largest navy in the world. It includes, besides others, 60 battleships, 20 armored cruisers, 100 protected cruisers, 80 torpedo boat destroyers, and 100 torpedo vessels. The total displacement of vessels is estimated at 2,150,000 tons. The revenues of the government for all purposes are derived from various sources, but the most important of the direct taxes is the income tax, which is levied on the income of individuals in graduated rates. In addition to this are the excise duties, inheritance tax, custom duties, house duties, stamp duties, and land tax. In 1924 the national debt amounted to $39,414,994,000. Many of the public utilities are owned by the government, such as the postal service, which includes a parcel post, and the telegraph lines.

INHABITANTS. The population of Great Britain, including Ireland, has been increasing steadily. However, Ireland has shown a constant decrease for many decades. London, the capital of the British Empire, located on the Thames, is the largest city in the world. In 1911 fifteen cities of England, two of Ireland, and two of Scotland had a population of more than 200,000. Owing to the great uplift in manufacturing enterprises, there has been a constant increase in urban population. Fifteen per cent. of the people of Wales speak Welsh only, 45 per cent of Ireland speak Irish only, and 63 per cent. of Scotland speak Gaelic only. The inhabitants of the United Kingdom in 1923 were 45,216,741. Of this number 4,381,951 were in Ireland, 4,759,521 were in Scotland, and 36,075,269 were in England and Wales.

COLONIES. The colonial possessions of Great Britain are more extensive than those of any other nation. The entire possessions embrace about one-seventh of the land area and nearly one-fourth of the inhabitants of the earth. All the more important islands and continental provinces are treated in separate articles. The table following does not include some of the minor possessions, nor the mandated regions acquired from Germany, and some of the unsurveyed territories may contain a greater or smaller area and population than stated. However, based upon the most recent reports, the table may be considered sufficiently accurate.

GREAT BRITAIN AND COLONIAL POSSESSIONS.	AREA IN SQUARE MILES.	POPULATION.
In Africa:		
Ascension Island	35	260
Basutoland	10,293	348,840
Bechuanaland Protectorate	386,200	120,770
Cape Colony	277,000	2,409,800
Central Africa Protectorate (British)	40,980	1,000,500
East Africa (British, Uganda, and Zanzibar)	289,258	8,200,000
Mauritius and dependencies	877	400,000
Natal (including Zululand, Amatongaland, and other districts)	35,371	1,108,750
Nigeria	310,000	25,000,000
Orange River Colony	50,392	387,315
Rhodesia	750,000	925,000
Saint Helena	47	3,882
Seychelles	148	20,275
Somaliland Protectorate	60,000	300,000
Transvaal	111,196	1,354,200
West African Colonies (Gold Coast, Lagos, Gambia, Sierra Leone)	138,260	4,263,700
In America:		
Bermudas	18	23,317
Canada	3,619,946	5,371,315
Falkland Island and South Georgia	7,500	2,044
Guiana (British)	90,500	302,170
Honduras (British)	7,562	39,968
Newfoundland	40,200	220,000
Labrador	120,000	4,000
In Asia:		
India (British and Native States)	1,766,642	294,361,056
Ceylon	25,333	3,812,931
Cyprus	3,584	237,022
Hong Kong	32	335,000
Aden, Perim, and Kuria Muria	101	41,406
Sokotra	1,382	12,000
Bahrein Islands	270	70,000
Borneo (British North)	31,106	200,000
Labuan Island	31	8,411
Brunei	4,000	12,000
Sarawak	41,000	500,000
Straits Settlements (Singapore, Penang, and Malacca)	1,542	572,249
Federated Malay States (Perak, etc.)	26,380	678,595
Wei-Hai-Wei (in Shantung)	1,785	150,000
In Australasia:		
Australia, Commonwealth of	2,972,918	3,925,000
British New Guinea	90,540	350,000
New Zealand	104,751	857,000
Fiji	7,435	121,773
In Europe:		
United Kingdom	121,089	45,216,741
Isle of Man	227	54,752
Jersey and Guernsey	76	95,700
Gibraltar	2	26,830
Malta	117	202,134
Pacific Islands:		
Tonga, or Friendly Islands	390	18,959
Other Islands	9,000	200,000
West Indies:		
Bahamas	5,450	56,135
Barbados	166	199,000
Jamaica and dependencies	4,424	806,690
Leeward Islands (Virgin Islands, etc.)	701	127,536
Trinidad (including Tobago)	1,868	273,900
Windward Islands	498	170,171

HISTORY. As a distinct name Great Britain was first used to distinguish the English government from that of Britainy in France, though it was employed only in a poetic sense until 1603, when James I. began to style himself King of Great Britain. In that year the crowns of England and Scotland were united by the accession of James VI. of Scotland to the throne of England as James I., but an independent legislative body was retained by each. The name Great Britain became legalized in 1707, when the two countries became organized as one inseparable union. Queen Anne, the last of the Stuarts, ascended the throne in 1702 and died in 1714. She was succeeded by George I. of the present house of Hanover. Twelve new peers had been created in 1711 and this gave the Tories a majority in the lords, but the rise of the house of Hanover caused the Stuarts to be exiled, and the insurrections that followed were soon suppressed. King George was supported by the Whig party, which remained in undisputed power nearly fifty years. During his reign Walpole rose to power and was a potent factor

in overcoming the panic that followed the failure of the South Sea Company. He was the first of the premiers, though he did not assume the title, and remained influential after the succession of George II., in 1727.

In 1739 Great Britain became involved in a war with Spain, though Walpole tried to avert it, and three years later he resigned rather than assume the responsibility of the Austrian Succession. He was succeeded by the ministry of Carteret, who participated in the War of the Austrian Succession, which proved unprofitable to England, but was rather fortunate for the house of Hanover. Charles Edward Stuart, the Young Pretender, invaded England while the war was in progress, but was finally defeated at Culloden in 1746. Ten years later, in 1756, William Pitt entered the Cabinet. He supported Frederick the Great in the Seven Years' War and advocated the war against France, which resulted in the loss of Louisiana, Canada, and India to the French. George II. was succeeded by George III. in 1760, and the new king immediately began to plan for a restoration of many of the royal powers that had been lost by his two predecessors. Pitt resigned from the Cabinet in 1761 and was succeeded by Lord Bute, but the latter soon gave way to Lord North, during whose ministry the Revolution in America began. The Treaty of Paris conferred independence on the American colonies in 1783, and as a result of the dissatisfaction that followed the younger Pitt became Prime Minister, retaining this position until his death in 1806.

The general attitude of republicanism in France after the Revolution along with other causes brought on a war with France in 1793. It resulted fortunately to England, since Nelson's victory at Trafalgar made Great Britain the supreme naval power, while the successes of Wellington in Spain and Portugal forced the Congress of Vienna to grant favorable terms to the British. However, Ireland undertook to obtain independence by force of arms and England soon after became involved in the War of 1812 with the United States. The reign of sixty years by George III. was ended in 1820, when George IV. ascended the throne. He had already served as regent for his insane father, during whose term of service the country had contracted an enormous debt, which greatly retarded economic and political reforms. In 1822 England opposed the alliance between Austria, Prussia, and Russia for the suppression of democracy, and five years later assisted the Greek patriots against Turkey. George Canning became Premier in 1827, but was soon succeeded by Wellington, who promoted a policy of reform. Catholic emancipation was granted in 1829. William IV. ascended the throne in 1830 and the following year Lord Russell introduced the first of the famous reform bills, which was indorsed after an appeal to the country by a large majority. Slavery was abolished in the colonies in 1833, new poor laws were enacted in 1834, and Upper and Lower Canada were united into one Dominion in 1837.

Queen Victoria began her long reign of 64 years in 1837. She exercised a very limited political influence, since the government was largely in the hands of the ministry. Among the principal events of her reign are the extension of territory and political power in India, the repeal of the Corn Laws, the invasion of Afghanistan in 1839, the Crimean War in 1854, the Opium War in China in 1840, the Sepoy Mutiny in 1857, the disestablishment and disendowment of the Irish Church in 1871, the proclamation of Victoria as Empress of India in 1877, the Anglo-Boer War in 1899, and the agitation for home rule in Ireland. Edward VII. succeeded his mother, Queen Victoria, in 1901, while the Anglo-Boer War was still in progress. At the conclusion of peace, in 1902, the territory of the Orange River Republic and of the Transvaal Republic was annexed to the British possessions. On the death of Edward VII., in 1910, his son, George V., succeeded to the throne. In 1914 the country declared war upon Germany and her allies and was a participant throughout the conflict. The greatest efforts of her fighting forces were exerted at sea and in the campaigns in France, Greece and Asia. Among the gains of the realm are the protectorate over Egypt, the mandatory over nearly all the German colonies, and an enlargement of trade and commercial possibilities. See **England** and page 666, Practical Home and School Methods.

GREAT EASTERN, the first of the large steamships built in Europe. It was constructed in 1854-58 at Millbank, England, for the Eastern Navigation Company, after designs made by Scott Russell, and intended for service to Australia by way of the Cape of Good Hope. The length was 680 feet; breadth, 83 feet; and height to the bulwarks, 70 feet. It had one mast of wood and five of iron and a capacity of 11,000 horse power, and could spread 7,000 yards of sail. The capacity was ample for 5,000 persons when all compartments were fitted out, though the design was to carry only about 1,000 passengers and devote the remaining space to the cargo. The cargo capacity was 20,000 tons. It cost $300,000 to launch the vessel, which was done on the Thames, Sept. 8, 1859. In 1888 it was sold at auction in Liverpool and broken up. The Great Eastern has been greatly surpassed in size and power by modern vessels.

GREATER PUNXSUTAWNEY, a borough of Jefferson County, Pennsylvania, 70 miles northeast of Pittsburgh, on the Pennsylvania and other railroads. It has glass works, planing mills, brickyards, machine shops, and cigar factories. Population, 1920, 10,311.

GREAT FALLS, a city in Montana, county seat of Cascade County, on the Missouri River, near its falls at the mouth of the Sun River, 98 miles northeast of Helena. It is on the Great

Northern and other railroads, within a region which produces large quantities of gold, silver, iron, coal, copper, and sandstone. Among the chief buildings are the county courthouse, the public library, the high school, and the Federal building. It has seven parks with a total area of 560 acres. Immense water power is derived from Rainbow and Great falls. Among the manufactures are earthenware, clothing, flour, machinery, and brick. It has large smelting and refining works. Great Falls was settled in 1884 and incorporated in 1888. Population, 1900, 14,930; in 1920, 24,121.

GREAT FISH, or **Back River,** a stream of Northern Canada, rises near Lake Aylmer, and flows into the Arctic by a wide estuary. Its source is in Mackenzie, whence it has a course of about 500 miles toward the northeast. It was discovered and explored by Sir George Back in 1834.

GREAT KANAWHA (kà-nạ'wà), an important river flowing into the Ohio, rises in the Blue Ridge Mountains of North Carolina. Its entire length is 410 miles, about 100 of its lower course being navigable. The upper portion is called New River, which has a general direction toward the northeast through Virginia, but makes a bold turn into West Virginia, and thence the Kanawha has a northwesterly course. Among the towns on its banks are Charleston, W. Va., and Pearisburgh, Va. The region through which it passes is rich in coal and iron deposits.

GREAT LAKES. See **Lakes, The Great.**

GREAT PEDEE RIVER (pē-dē'), a stream formed in North Carolina by the confluence of the Yadkin and Rocky rivers. It passes into South Carolina, where it receives the Little Pedee, and flows into Winyaw Bay at Georgetown. It has a total length of 415 miles and is navigable to Cheraw, a distance of 150 miles.

GREAT SALT LAKE, a body of salt water situated in the northern part of Utah. It is about 85 miles long, from 20 to 48 miles wide, and is 4,150 feet above sea level. Its only outlet is by evaporation, hence the water is one of the most concentrated salt brines known in the world, containing about 20 per cent. of sodium chloride and slight quantities of other salts. No fish subsist in the lake, but its shores are frequented by gulls and wild fowl. The discharge from Lake Utah, a fresh-water lake, is carried into it by the Jordan from the south. Other rivers flowing into it include the Ogden, Bear, and Weber.

The first account of this lake was made in 1689 by Baron La Hontan (1667-1715), who based his report on information given by the Indians. In 1776 Escalanta, a Franciscan friar, mentioned the lake and Frémont explored it in 1843. The adjacent geological formations give evidence that in early times the lake was an immense body and at least 1,000 feet deeper than at present. The present average depth is about 18 feet and at its deepest point it is about 35 feet. The valleys lying adjacent have been improved greatly by irrigation, and now constitute the richest part of the State. Numerous railroad lines traverse the adjacent country, and near it are the thriving cities of Salt Lake City, Ogden, and Logan. A line of the Southern Pacific Railroad crosses the lake, passing almost due west from Ogden.

GREAT SLAVE LAKE, a large, irregular fresh-water lake in Mackenzie, Canada, about 325 miles long and 80 miles wide. The area is 7,100 square miles. It has irregular shores and numerous islands, and is frozen over half the year. The discharge from Athabasca Lake flows into it, and its surplus waters are carried to the Arctic by the Mackenzie River.

GREAT WALL. See **Chinese Wall.**

GREAT WAR VETERANS' ASSOCIATION, a patriotic organization of Canada, founded in 1919, and maintained by the participants in the Great European War. The purposes include to defend the constitution of the Dominion, to maintain law and order, to foster peace and good will, and to transmit the principles of justice to posterity. R. B. Maxwell was prominent in promoting the organization and officiated as one of the early presidents.

GREBE (grēb), the name of a water bird common to Europe and America, peculiar in that the feet are not webbed. Each toe has a separate membrane, which is united with the membrane opposite. It has no visible tail. Nine species are common to North America, ranging from Mexico to the southern part of Canada. They are quite numerous along the eastern coast and are known locally as *dippers* and *hell-divers.* The *crested grebe* is one of the larger species and has the finest plumage.

GREECE, a republic in Southeastern Europe, occupying the most easterly of the three peninsulas that project from Europe into the Mediterranean. The northern boundary is formed by Turkey, eastern by the Aegean Sea, southern by the Mediterranean, and western by the Ionian Sea. It extends from latitude 40° north southward to latitude 36° 23'. The length from north to south is about 250 miles and the greatest breadth is 180 miles. Many islands are located in the Aegean and Ionian seas, most of which appear to be the summits of sunken volcanic formations. The boundaries of the interior provinces are formed largely by mountain ranges, all of which have associated with them historic incidents of much interest. Together with Crete, the Ionian Islands, the Euboea, and the Cyclades, it has an area of 49,022 square miles.

DESCRIPTION. A continuation of the Balkan Mountains, known by the general name of Pindus, extends across the boundary line from Turkey and divides and subdivides into numerous chains. The coast line is extraordinarily irreg-

ular, being indented by many gulfs and bays valuable in commercial enterprises. The numerous islands that belong to Greece are separated from the mainland and from each other by navigable channels, and like the mainland contain numerous mountain elevations. Olympus, 9,750 feet high, supposed to have been the dwelling place of the gods in ancient times, is located on the northern boundary. It belongs to the eastern extremity of the Cambunian Mountains. Other mountain peaks include Parnassus, 8,075 feet, and Cithaeron, 4,615 feet, in central Greece; and Taygetus, 7,900 feet, situated in the Peloponnesus. A number of plains are located in different sections of the country, but all of them are surrounded by chains of mountains. The great plains of Thessaly, in the northern part of Greece, are the most extensive. They are level and woodless, but have a very fertile soil and may be regarded the granary of the kingdom. Other plains are located in Argolis, Boeotia, and Messenia.

The rivers of Greece are numerous, but all are quite small and unimportant, except as they are associated with legends and history. None of the streams is important for navigation or water power. The greater number dry up during the summer, others disappear in sinks in limestone, and only the largest flow the entire year. The Achelous, which flows into the Ionian Sea north of the Gulf of Patras, is the most important river. The Iri (Eurotas) and the Alpheus are the chief rivers of the Peloponnesus. Aside from the Messongi, on the Island of Corfu, there are no streams in the islands. The mountainous regions have a number of lakes, many of which have no visible outlet to the sea, the surplus being drained through porous limestone. Lake Copais in Boeotia is the largest inland body of water. The Gulf of Lepanto or Corinth, located northwest of Athens, is almost surrounded by land, and is connected with the Gulf of Patras, an inlet from the Ionian Sea, by a narrow channel.

Climate. As a whole, the climate is temperate and salubrious. The atmosphere is remarkable for its clearness and beauty, rivaling the Italian sky, and the country is generally healthful, though it is not thought to be as agreeable as it was in ancient times. The sirocco winds from Africa make some of the summer days very hot, almost unendurable, and the cold of winter is somewhat intensified by the winds blowing from the snowy mountain summits of the north. Frosts and snowfalls rarely occur in the lowlands, but the summits of mountains are visited by heavy snows in the winter. The eastern part is subject to droughts, hence irrigation is necessary for many farm crops, but the western region has an abundance of rainfall. A larger part of the precipitation takes place in autumn and winter and the summers are generally very dry. On the plains and some of the coasts the soil is quite fertile, hence the yield of produce gives greater returns than any time since Greece had its ancient prosperity.

Mining. Lead is the most important of the minerals, the yield being about 30,000 tons per year. Lignite coal is found in Euboea, but the supply is quite limited. Important deposits of iron and copper are known to exist, but the scarcity of fuel has prevented them from being worked to any extent. Gypsum, salt, and sulphur deposits of considerable value are found in various localities. Fine marble is obtained in Paros and Pentelicus and emery occurs in Naxos and other islands. Building stone, especially limestone, is very abundant.

Agriculture. Greece is principally an agricultural country. The ownership of the land is vested largely in the peasant farmers, who must depend to a considerable extent upon irrigation. Nearly half of the tilled land is used in the cultivation of cereals, but the supply of wheat and other grains is not sufficient for the home demand. In the region of Elis, where the lands are low and well watered, a superior quality of rice is grown. Fruits are cultivated very extensively, especially currants, grapes, figs, lemons, oranges, apples, and pomegranates. The mulberry tree is propagated extensively as an adjunct of the silk industry and vegetable gardening is an enterprise of much value. Sheep are the most important of the domestic animals, while goats are reared for their milk, from which butter and cheese are made. Other domestic animals include horses, cattle, and swine. Bee culture has been practiced from ancient times. The forest area is very small, this being due to the fact that the large number of goats tend to kill the young trees, but some attention is given to forestry.

Manufacturing. Greece is especially adapted to the production of wines that are rich in color and alcohol, hence their manufacture receives marked attention. Most of the manufacturing enterprises are conducted in small shops, many of which are located near the towns and in the country. Peasant women weave carpets in their houses and engage locally in spinning and sewing. Flour is ground in many of the towns and cites. Piraeus is the center of cotton, wool, and silk factories. The fisheries yield many commercial products, especially the sponge fisheries of the Aegean Sea. Other manufactures include machinery, clothing, utensils, toys, leather, soap, and sailing vessels.

Transportation and Commerce. Greece had 1,500 miles of railways in 1923. Electric lines and tramways are operated in the cities and in some sections of the rural districts. About 2,200 miles of good highways are maintained and 6,500 miles of telegraph lines are in operation. Much of the transportation is by the sea. The Corinth Canal, completed in 1893, crosses the Isthmus of Corinth and connects the Aegean with the Ionian Sea. It is the seat of an important commerce, since it furnishes a short and safe route

between points in Italy and Constantinople. A railway line parallel to the Gulf of Corinth has been in operation a number of years, furnishing transportation facilities between Athens and Patras, and important lines are being constructed to connect the chief centers of Greece with those of the central part of Europe. The imports exceed the exports, the former being about $36,500,000 and the latter $27,500,000. Foreign trade is chiefly with Great Britain, Russia, Austria, Turkey, Germany, France, and Italy.

Education. The state of education has been greatly neglected, in consequence of which many of the people are unable to read and write, the proportion of illiteracy being about 25 per cent. This is due not so much to the inclination of the Grecians, but more particularly to the fact that the country has been subject to distracting internal and foreign wars. These causes have brought about a low state in the national finances. Within recent years the school system has been modeled after that of Germany, in which the *Realschulen* are important factors in fitting for the industries. By national law all children between six and twelve years of age are required to attend school, but the law has not been enforced strictly in the more impoverished districts. Besides the public elementary schools, there are private institutions and a system to promote higher education, including numerous colleges, academies, and the national university at Athens. A number of European and American colleges have been established to promote the investigation and study of antiquities with the view of adding to general knowledge of Grecian art and history. Religious worship is free and unrestricted, though a very large majority of the people belong to the Greek Catholic Church, which is the official religion. The Christian sects aside from the Greek number about 25,000, while the Mohammedans have about the same strength and 6,000 are Jews.

Government. The government is a constitutional monarchy, of which the king is the chief executive. Legislative power is vested in a chamber of deputies known as the *Boulé*, which meets in Athens annually, and its members are elected by popular vote. The six heads of departments compose the ministry, and they are responsible to the chamber of deputies. Service in the army is compulsory from the ages by nineteen to forty years, if necessary, though two years' service with the *colors* enables admission to the *reserve*, and the remainder to the *Landwehr*, these three divisions constituting the army. On a peace footing the military force numbers 25,180 men and the reserve is 98,000. The entire navy as now organized is composed of forty vessels of all classes. The drachma, equivalent to the franc, is the monetary unit. Greece adopted the metric system of weights and measures in 1898 and maintains an efficient postal service.

Inhabitants. The modern Greeks resemble the Iberians of Spain and the Ligurians of Italy. In stature they are medium, averaging about five feet six inches, and the hair, skin, and eyes are dark. About one-tenth of the people are Albanians and the remainder of the inhabitants are Greeks. Not more than one-third of the Greek people live in Greece, the remainder being distributed largely in European Turkey, Crete, Asia Minor, Cyprus, and the United States. Athens, the capital, is the largest city and chief center of trade. Other cities include Corfu, Piraeus, Patras, Larissa, Volo, and Zakynthos (Zante). The total population in 1907 was 2,631,952; in 1928, 6,050,780.

Language. The Greek language is a branch of the great family of Indio-European languages, and was spoken as early as the 15th century B. C. From Asia Minor and southeastern Europe it was carried by colonies of Greeks to Sicily, lower Italy, and other regions on the Mediterranean. Ultimately it became the spoken language of Macedonia, Syria, Egypt, and the Byzantine Empire. Ancient writers, especially those associated with Greece and Rome, trace the language to a race of people called by them Pelasgi, who were regarded by some more recent writers as of Gothic origin, and who were undoubtedly the people from whom both the Greeks and Romans had their origin. Little was known of the Greek language to the people of Western Europe during the Middle Ages, but with the revival of learning came a renewed interest in the language and literature of the Greeks, who came to be known as a people of much culture and refinement. The Dutch scholar, Erasmus (q. v.), not only induced a widespread interest, but carried Greek as a branch of study to Cambridge University in 1510.

Three distinct dialects, known as the Ionic, Doric, and Aeolic, were spoken in the historic period of ancient Greece. Of these the first two were the most important, since they entered more largely into the literary treasures of the Greek masters. The Ionic was the dialect used by Homer, Hesiod, and Herodotus, and thus is embodied in the master productions known to modern students. In northern Greece and the colonies the Doric prevailed largely, and it is represented in the writings of Pindar and Theocritus. As a whole, the language was remarkable for its beauty and elasticity, on account of which many of its elements are retained in the modern European languages. The spoken tongue was greatly influenced by the Roman conquest, after which many Latin words were incorporated with the vocabulary. However, the classical forms are well preserved in the modern language, making it possible for a student of ancient Greek to read the modern tongue quite readily. The Germanic languages, especially the English and German, have incorporated many words from the Greek, but the words of Greek origin are comparatively few as compared with the number derived from a Latin source.

LITERATURE. Much of Greek literature, as known to modern writers, is as old as the history of the Greek language. The first works known to us as Greek writings are the "Iliad" and the "Odyssey," two productions generally attributed to Homer. They are unlike the first writings that have come down to us from other nations in that their language is highly cultured, instead of being a recital of simple fable or folklore. From this it is evident that learning had flourished long before the time of Homer, and that the poetic art had a firm hold upon the Greeks many centuries before the Christian era. Both these productions are epic poems, the "Iliad" treating of the war against Troy, and the "Odyssey" reciting the adventures of Odysseus, a celebrated Greek hero of the Trojan War, while on his return voyage to Greece. It is generally assumed that these epics were passed from generation to generation in a spoken form, and that they were not committed to writing until after many years. This circumstance has given rise to doubts as to their authorship, it being quite probable that Homer only collected and compiled them into convenient form.

Hesiod, the eminent poet of nature, flourished about a hundred years after the time of Homer and is the author of "Works and Days," an epic treating of farm life and work. It contains many general reflections on domestic virtues, industry, and poetic art. The same writer gives a genealogy of Greek gods and heroes in his "Theogony." Lyric poetry had its rise in the latter part of the first period, and its finest examples are embodied in the writings of the poetess Sappho, and Alcaeus, Alcman, and Pindar. The latter was, perhaps, the greatest of all lyric poets, his productions treating of the heroes associated with the Olympian and other festal games. It was the custom in Greece to recite the epics in the family before retiring at night, while the lyrics were sung at the festivals given on state occasions and in the homes of the wealthy classes.

Greek literature is particularly rich in drama and history and attained its height of importance in the oratory of Attica. In the Golden Age of Greece the literature reflected the political glory and educational importance of the Hellenes. The drama rose as a means to educate the common people in religious duties, as well as to instruct them in government and the industries. The dramatical works reached their highest perfection in the Age of Pericles, when vast theaters were built to accommodate large audiences, the largest at Athens. Sophocles, Aeschylus, and Euripides are among the best known writers of tragedy, and Aristophanes has the highest place among the writers of comedy. Herodotus stands preëminent as the greatest historian of Greece. We are indebted to him for much of our knowledge of early peoples, including the Chaldaeans and Babylonians, and many events in the Persian wars. Other historians of note were Thucydides and Xenophon. The former is best known for his "History of the Peloponnesian War," and the latter by his "Recollections of Socrates" and "Cycropaedia," a history of Cyrus the Great.

Socrates stands preëminent among the philosophers and is closely associated with Plato and Aristotle, these three being the greatest philosophical teachers of antiquity. We are indebted to Plato for a knowledge of the teaching of Socrates, the latter leaving no written works. Plato is the author of "Dialogues," a work that has exercised marked influence on modern thought. Aristotle wrote on metaphysics, logic, economics, physics, and rhetoric. No less important than Grecian philosophy is the oratory of the Hellenes. To be an orator was not only regarded a high accomplishment, but oratory was taught as a special branch of study, and expert teachers found lucrative employment in writing speeches. Antiphon was the first of the ten great orators, but Demosthenes ranked as the most eminent, and his efforts are taken as the highest perfection in the art. The most noted oration of the former is "On the Murder of Herodes," while the oration of Demosthenes entitled "Oration on the Crown," which was directed against Aeschines, and his "Philippics" against Philip of Macedon, were the most effective in arousing the Athenians against the Macedonians. Other great orators include Pericles, Lysias, and Isocrates. The three philosophical schools of Greece were the Stoics, Epicureans, and Skeptics, with which are associated respectively the names of Zeno, Epicurus, and Pyrrho.

The Alexandrian Age of Greek literature is the last period in the literary development of ancient Greece, being so called from the rise of Alexandria in Egypt. It embraces the epoch from the division of the empire founded by Alexander the Great to the conquest of Greece by the Romans, from 300 to 146 B. C. In this period Greek scholars influenced learning in Egypt and aided in producing the Septuagint version of the Old Testament, the name applied to the translation from the Hebrew into the Greek made by seventy scholars at Alexandria. Among the writers of this period are Theocritus, author of "Idylls," Euclid, Archimedes, and Aristarchus, the last mentioned being a forerunner of Copernicus. The scientist, Strabo (50 B. C.); the astronomer, Claudius Ptolemy (150 A. D.); and the historian Plutarch, are among the later writers to enrich the literature. Plutarch, a Greek-Italian writer of the 14th century, had a modifying influence on Greek literature as the author of "Parallel Lives," in which he contrasts many Greek soldiers and statesmen with the leaders of Rome.

Modern Greek literature has its beginning with the fall of Constantinople, in 1453, but the early productions of this period are character-

ized by the defenses of orthodox traditions as against the Latin heresy. In this respect they are a continuation of the spirit of Byzantine literature. However, comparatively little of permanent value was produced until the 18th century, when the works in fiction and poetry began to multiply. In the 18th century many dramatical works were translated from Lessing, Shakespeare, Schiller, Goethe, and other English and German writers by Alexander Rangabé and Demetrios Bernardakis. A revival of the spirit of nationality in the 19th century has stimulated many current works. The improved condition of schools and institutions of higher learning is having a wholesome and elevating effect in literary lines.

History. Historically, Greece occupies an important position, though mostly because of its glory in the remote past. Hellen is its fabled ancestor, who was regarded the son of Deucalion and Pyrrha, two survivors of the deluge. From him descended the four celebrated divisions—the Dorians, Ionians, Aeolians, and Achaeans. Collectively, these were called *Hellenes* and the country became known as *Hellas,* the names by which the Grecians still call themselves and their country. The Italians originated the word *Greek* from their northern tribes *Graeci* which, through the Romans, passed into common usage among the Europeans. The Achaeans were renowned in war, but the Ionians and Dorians were the most important divisions, and respectively founded the two great cities of Athens and Sparta. A people called the Pelasgians occupied the country before the Grecians secured possession, but they probably were earlier Aryan immigrants from Asia, since they were readily assimilated by the intellectually superior Grecians. Phrygia in Asia Minor is regarded the nativity of the Grecians before coming to Greece, and it is thought that they came by way of the Hellespont to the islands of the Aegean Sea. Civilization and religious rites were brought over from Egypt and Phoenicia.

The Heroic Age of Greece has reference to the historic events of Hercules, Theseus, Minos, Jason, and the celebrated Trojan War, all of which are treated in special articles. It is thought that the Trojan War occurred about 1194-84 B. C. Authentic history begins about 1000 B. C., at which time the celebrated Dorian invasions of two centuries were ended. These were followed by the establishment of the Dorian states in the Peloponnesus, the successive invasions of Asia Minor, and the conquests of Crete, Rhodes, Cos, and other islands of the Ionian and Mediterranean seas. The best picture of early Greek life is given in the famous works of Homer, the "Iliad" and "Odyssey." While mixed with poetic fancy, they make us acquainted with the Grecian deities, customs, industries, games, commerce, and arts of war.

The Dorians and Ionians were long powerful rivals for supremacy among the Hellenes. While the former established their stronghold at Sparta, the latter made Athens their seat of influence. Lycurgus prepared a code of laws for the Spartans, under which the people secured greater rights and developed material prosperity. The culture of Sparta was military, a condition brought about largely by the need of means of defense and the promotion of commerce. At Athens, Solon prepared a code of laws, repealing many that inflicted severe forms of punishment. His laws made ample provision for the intellectual, physical and moral culture. Under the legislation introduced by Solon splendid temples and public improvements were built, libraries were founded, and learning was patronized. Though hostile to each other, the several states of Greece united when King Darius of Persia landed at Marathon in 490 B. C. for the purpose of conquering the Athenians. In the battle that ensued, Miltiades led an army of 10,000 Athenians and succeeded in defeating the Persians, the battle being classed as one of the decisive engagements of the world.

In 432 B. C. the Spartans began a general war to conquer Athens and after 27 years established Spartan supremacy. The oppressions that followed caused an alliance between a number of the states and the Persian king, and in 371 led to the defeat of the Spartans at Leuctra. Greece attained its height of prosperity and military power during the Macedonian supremacy, particularly under Alexander the Great, son of Philip of Macedon, who reigned in 336-323 B. C. This great leader defeated Darius, overthrew the Persian Empire, annexed large parts of Asia and Africa, and among other cities founded Alexandria. The brief reign of Alexander was followed by internal dissensions and an invasion by the Gauls in 279 B. C., and the nation was threatened by the states that rose in the West. Had Greece remained united by strong internal ties, it might have predominated over the Romans, but, owing to local differences, all of Greece became a Roman province after the capture of Corinth in 146 B. C. Under Roman rule a period of peace and prosperity prevailed.

The Goths invaded Greece in 395 A. D. and captured many of its cities. However, Rome was divided in the same year into the Eastern and the Western empires, by which the country became incorporated with the former. It remained an integral part of the Byzantine Empire (q. v.), with its capital at Byzantium, until that city, whose name had been changed to Constantinople, was captured by the Turks in 1453. While belonging to the Byzantine Empire it retained renown for its learning and was turned from paganism to Christianity.

In 1453 Greece was conquered by Mohammed II., and in 1669 it came under absolute control of the Turks. A war of independence began in 1821 under the leadership of Alexander Ypsilanti. With the help of Russia, France, and England it finally threw off Turkish rule in

1828. The Greek statesman, Count Capo d' Istria, became president, but in October, 1831, he was assassinated. The powers in 1832 elected Otho, second son of the King of Bavaria, as King of Greece, who reigned thirty years.

George I. was elected to the throne in 1863 by the national assembly. He granted a liberal constitution, which went into effect in 1864. The treaty of Constantinople required Greece to pay a war indemnity of $18,000,000 and rectified the frontier between Greece and Turkey. Greece joined the Balkan alliance in 1913 against Turkey, and attained many advantages, including the acquisition of Crete and other territory. George I. was slain by an insane man Mar. 18, 1913, and was succeeded by his son Constantine I. He was deposed by England, France and Russia on the charge of being pro-German, in 1917, and his second son, Alexander, was chosen king. Greece now became a factor in the war and declared hostilities against Bulgaria and Germany. The Versailles Treaty added considerable territory to Greece, both in Europe and Asia Minor, but the latter was lost to Turkey in 1922. Paul Koundouriotis was elected president in 1926. See page 666, in the last volume of these books.

GREEK CHURCH, one of the Christian sects, whose official title is Holy Orthodox Catholic and Apostolic Church. Its membership is confined largely to the countries formerly under the Byzantine Empire and to Russia. Three distinct branches of this faith are recognized, which are known as the Orthodox Church in the Turkish Empire, the Orthodox Church of Russia, and the National Church of Greece. Each of these has a definite head, but in points of doctrine and practices they are closely allied. The Orthodox Church in the Turkish Empire is presided over by the patriarch of Constantinople, who is under the protection of the Sultan, and with it are affiliated the patriarchates at Alexandria, Antioch, and Jerusalem. The Holy Synod of Saint Petersburg is the primary influence of the Orthodox Church of Russia, but the Czar is the temporal head of it and of the whole Greek Church. The Holy Synod of Greece, established in 1833, is at the head of the National Church of Greece. Prior to 1054 the adherents of the Greek Church were a part of the Roman Catholic denomination, but in that year the two branches became separated, largely on account of contentions regarding papal supremacy and vital doctrinal points.

The Greek Catholics teach seven sacraments, those of baptism, confirmation, eucharist, penance, extreme unction, holy orders, and marriage. They reject the word *purgatory* and the papal supremacy, but admit there is purgation after death and pray for the dead. They practice triple immersion, teach transubstantiation, and use leavened bread in giving the Lord's Supper. The pictures of the saints and the Blessed Virgin are very common in churches, but the crucifixes are not used. No seats are provided for the worshipers, who stand during the entire service, and instrumental music is not permitted in the churches. Many formal ceremonies are used and periods and days for fasting are numerous. Clergymen are usually required to marry before they are ordained, but bishops do not marry. Formerly the archbishop of North America was resident in Alaska, but his seat is now in New York City. The Greek Church of the world at present has a total membership of about 100,000,000, of which 90,300,000 are in Russia. The Greek Orthodox Church has 201,500 communicants in the United States and the Russian Orthodox has 255 churches and 275,000 members.

GREEK FIRE, the name applied to several inflammable and destructive compounds used in military operations during the Middle Ages. A preparation of this kind was employed extensively by the Greeks of Constantinople, who used it both in naval and military warfare. The simplest weapon was the hand tube, which was filled with combustibles of various kinds and flung by the hand against the buildings and upon the vessels of the enemy, serving to inflict damage and set fire by the explosion that followed. The use of explosive compounds of various kinds gave the Greeks superiority for centuries, and the art of manufacturing them was concealed for a long time at Constantinople. They were made principally of sulphur, naphtha, and niter. A compound of sulphur, saltpeter, and lampblack has been used for a similar purpose in modern warfare. Bunsen made an agent of this kind and called it the *kakodyl,* which somewhat resembles the Chinese stinkpot, both having a deadly efficiency through the use of arsenic.

GREELEY (grē'lĭ), **Horace,** journalist, born in Amherst, N. H., Feb. 3, 1811; died Nov. 29, 1872. He secured a common school education, learned the printer's art at East Poultney, Vt., and became assistant editor of the *Northern Spectator.* He came to New York City in 1831 with a capital of $10. Shortly after he engaged in printing and in 1834 established *The New Yorker.*

HORACE GREELEY.

In 1840 he published the *Log Cabin,* a weekly newspaper which attained a circulation of 80,000. and was of material aid to W. H. Harri-

son in the presidential election of that year. The success of this publication gave him considerable prestige in founding the *Daily Tribune* in 1841, which he edited until his death. He was elected a member of Congress in 1848, in which body he advocated many reforms and introduced the first bill giving free homesteads to actual settlers. In 1851 he visited Europe on a commission to the Crystal Palace Exposition held in London.

During the Civil War Greeley supported the Union, advocated the election of President Lincoln, and, after the surrender of General Lee, favored general amnesty and universal suffrage for the purpose of bringing about a better feeling between the North and South. He went to Richmond in 1867, where he signed a bail bond for Jefferson Davis, an act that met with strong condemnation in the northern states. He was nominated by the Liberal Republicans and Democrats in 1872 for the Presidency against General Grant, but met with defeat. The extraordinary strain of the election and the decease of his wife caused an illness from which he died a few weeks later. Greeley was an able journalist, an influential and popular orator, and a careful student of men. Among his best known writings are "The American Conflict," "Glances at Europe," "Recollections of a Busy Life," "History of the Struggle for Slavery Extinction," and "What I Know About Farming."

GREELEY, county seat of Weld County, Colorado, on the Cache la Poudre River and on the Union Pacific and other railroads. It is in a farming country and has sanitary sewers, paving, electric lights and railways, and a brisk trade. The features include a high school, city hall, public library, courthouse, and federal building. It was settled in 1870 and was incorporated in 1871. Population, 1920, 10,883.

GREELY, Adolphus Washington, explorer, born in Newburyport, Mass., March 27, 1844. He graduated at the Brown high school in 1860, served as a volunteer in the Civil War, and at its close entered the regular army as lieutenant. He was assigned to the signal service in 1868 and subsequently superintended the construction of military telegraph lines in the West. In 1881 he was appointed by the government to conduct an expedition into the Arctic regions. In the same year he sailed from Saint John's, Newfoundland, and, after three years of endurance and hardships, he and six survivors of his party of twenty-five were rescued at Cape Sabine in 1884, eighteen of his men having died from starvation.

GREEN, John Richard, historian, born at Oxford, England, in December, 1837; died in Mentone, France, March 9, 1883. In 1860 he graduated from Cambridge. Shortly after he became curate in London, contributing occasionally to the *Saturday Review.* In 1874 he published "The History of the English People" in four volumes, by which he secured a wide reputation. Later he collected a number of essays and placed them before the public in 1877 under the title, "Stray Studies," and in 1882 completed his work entitled "The Making of England." His last great work to be published is "The Conquest of England," which appeared shortly before his death.

GREEN, Seth, naturalist, born in Rochester, N. Y., March 19, 1817; died there Aug. 20, 1888. After receiving a common school education, he became interested in the management of a fish and game market and grew fond of hunting and fishing. His attention was attracted to the spawning of the salmon, and he thereby developed much knowledge and interest in the artificial propagation of fish. To overcome the tendency of male salmon to consume the spawn laid by the female, he invented an apparatus to hatch 95 per cent. of the eggs, and by means of it was successful in protecting them. In 1867 he succeeded in hatching 15,000,000 shad at Holyoke, Mass., and in the meantime carried on the industry in the Potomac and Hudson rivers. Among his publications are "Trout Culture" and "Fish Hatching and Catching." His service rendered in extending knowledge and success in fish culture was recognized by numerous American and foreign societies. In 1868 he was made fish commissioner of New York and later became State superintendent of fisheries.

GREEN, William, labor leader, born at Coshocton, Ohio, March 3, 1873. He was educated in the public schools and engaged in coal mining. From 19000 to 1906 he was subdistrict president of the United Mine Workers of America, in which he continued to hold various offices of responsibility. He is a Democrat in politics and attended several national conventions. He was elected president of the American Federation of Labor, as successor to Samuel Gompers, in 1924. In the administration of this office he followed the policy of his eminent predecessor, and was highly complimented for his firm stand in favor of law and order in opposition to communism and anarchy.

GREENAWAY (grēn'ä-wā) **Kate,** artist, born in London, England, in 1846; died Nov. 6, 1901. She was the daughter of a wood engraver, under whom she studied, and later attended an art school at South Kensington. In 1872 she exhibited a number of black and white designs at the Dudley Gallery, in which she showed marked and original talent. Her illustrations are superior in that they exhibited originality and simplicity in delineating child life, and in this respect rank with the drawings of Walter Crane. Her productions include many illustrations which were used in almanacs and periodicals. Among the best known of her own publications are "Kate Greenaway Little Folks' Painting Book," "Language of Flowers," "Under the Window," and "A Day in a Child's Life."

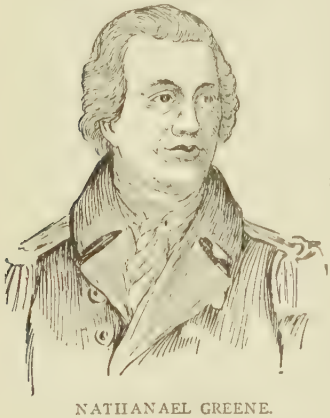
GREENBACK PARTY, a political organization of the United States, formed in 1876, called by its members the Independent National party. The name *Greenback* was attached to it because it favored the larger use of "greenback" currency, a class of legal tender notes issued by the government during the Civil War. It had for its main tenets the repeal of the specie resumption law enacted in 1875, suppression of national bank paper, and the circulation of United States notes. It advocated the freer use of silver money. Peter Cooper, its candidate, received 81,740 votes for President in 1876; J. B. Weaver, 308,578, in 1880; and B. F. Butler, 175,375, in 1884. Ultimately it became merged in the People's party.

GREEN BAY, a city in Wisconsin, county seat of Brown County, on Fox River, 112 miles north of Milwaukee. It is on the Chicago and Northwestern, the Chicago, Milwaukee and Saint Paul, and other railroads, and has communication by steamboats and electric railways. The harbor is ample for the accommodation of the largest lake steamers. The noteworthy buildings are the public library, the county courthouse, the high school, the post office, and the State reformatory. Hagemeister Park is a fine public resort. The streets are well paved and improved by modern facilities. Among the manufactures are flour, clothing, furniture, soap, bread, caskets, cigars, and machinery. The surrounding country is agricultural. Numerous calcic magnesic springs are within a short distance of the city, which have made Green Bay a favorite health resort. It has a large trade in lumber, cereals, live stock, and dairy products. Green Bay was settled in 1745 and chartered as a city in 1854. Fort Howard was united with it in 1896. Population, 1905, 22,854; in 1920, 31,017.

GREEN BRIER (brī'ĕr). See **Smilax.**

GREENBUSH. See **Rensselaer.**

GREENE, Nathanael, general, born in Warwick, R. I., June 6, 1742; died in Mulberry Grove, Ga., June 19, 1786. He was brought up as a Friend, became a member of the Rhode Island Assembly in 1770, and joined a military company in 1774. The following year he was commissioned brigadier general and given command of the forces in the vicinity of Boston. On account of distinguished service at Dorchester Heights, he was made major general and displayed great bravery and fortitude at Trenton and Princeton. He commanded a division at Brandywine and saved the American forces from defeat by skillful and rapid marches. In 1778 he became quartermaster general, but retained his rank to fight in the field. He succeeded General Gates in command of the southern army in 1780, which he reorganized, and in the same year presided at the trial of Major André. His campaign through South Carolina shortly after was of material value to the Americans, whose cause he strengthened by capturing forts Motte, Watson, and Granby, and in the meantime gained victories at Augusta and Eutaw Springs. Congress voted him a medal and title to lands in South Carolina and Georgia owing to his superior skill and valuable service. As a general and in military maneuvers he was among the most successful of the Revolution, second only to Washington. These two noted generals were firm friends and were in strict agreement regarding all material points relating to the conduct of the war for independence. After the war he lived in Mulberry Grove, where he died of sunstroke.



NATHANAEL GREENE.

GREENFIELD, county seat of Franklin County, Massachusetts, in the valley of the Green and Connecticut rivers, eighty miles northwest of Boston. It is on the Boston and Maine Railroad and several electric lines. The surrounding country is farming and stock raising, which makes the town a central shipping point. Among the chief buildings are the public library, the Franklin County Hospital, the townhall, and several fine schools. It has a monument erected to the soldiers. The manufactures include taps and dies, machinery, bicycles, and cutlery. It was settled in 1686 and was incorporated as a town in 1753. Population, 1925, 15,246.

GREEN GAGE, the name of a luscious kind of plum, cultivated quite extensively in America and Europe. The tree is small and spreading, but bears abundantly and quite regularly, and the fruit ripens in August. Chancellor Livingston brought it from France to America, and it has been cultivated for many years in the eastern part of the United States and the southeastern section of Canada. The fruit is juicy and of a green or yellowish color.

GREENHEART, or **Bebeeru,** the name of a valuable tree of South America, found chiefly in Guiana and the northern part of Brazil. It yields the *bebeeru* bark, which is used in medicine. The seeds are rich in starch and the natives use them as food. However, the greenheart tree is most valuable for its wood, which is hard and durable and takes a high polish. It is used extensively in turnery and shipbuilding. The tree has a tapering trunk about fifty feet high and four feet in diameter, hence yields a large quantity of lumber.

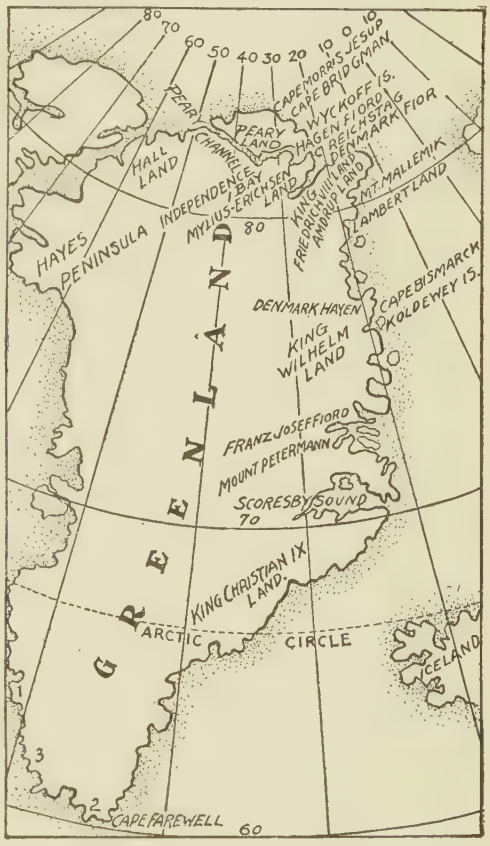
GREENHOUSE, a structure designed to furnish protection for plants. Formerly greenhouses were built principally to protect exotic

and other tender plants that were grown for ornamental or scientific purposes, but more recently structures of this kind came into wide use as forcing houses for the growth of plants out of their season. Greenhouses are kept for the latter purpose either to grow plants for resetting or to raise them for the early market, and are sometimes called hothouses, conservatories, or warm houses. The construction is usually simple, consisting of a framework of wood, or of wood and iron, and the principal walls and the roofs are of glass. This form prevents the escape of artificial heat and admits a large amount of light and heat from the sun. In colder regions the greenhouses are heated by systems of steam or hot water heating, but in warmer sections, such as the southern part of the United States, they can be maintained for at least some purposes without artificial heating. The construction of large greenhouses has made it possible to market flowers and ornamental plants at all seasons of the year, as well as to place vegetables on sale much earlier than they can be grown in gardens.

GREENLAND, called Grönland by the Germans and Danes, a large island situated northeast of North America. It is separated from the continent by Smith Sound, Baffin Bay, and Davis Strait. Although the area has not been determined, it is thought to be 512,000 square miles. It is 1,500 miles long and 690 miles wide at the broadest point and extends a short distance south of latitude 60° north. The northern portions are unknown, owing to the vast fields of ice common to that region and its extreme severity of climate. All of the interior is uninhabitable and is characterized by great glacier sheets of ice, many of which rise to heights approximating 9,000 feet. The average thickness of the ice mass in the northern portion is estimated at 1,000 feet. Great fiords indent the coast and vast icebergs drop into the sea.

Only the southern part of Greenland is inhabited, the settlements being confined to a narrow strip along the coast. Cultivation is carried on in the valleys of the low shore regions and several of the many islands lying off the warmer coasts in the southern part. The trees include alder, birch, and pine, but they partake more of the nature of shrubs. Barley and oats have been cultivated to a limited extent, but vegetables, including potatoes, radishes, cabbages, and turnips, are the leading agricultural products. Fishing and hunting are the principal occupations. The fisheries yield whale, halibut, seal, shark, cod, and stock fish, while the chase is rich in ermine, lemming, polar bear, Arctic fox, musk ox, and Arctic hare. The Eskimo dog and reindeer are the principal domestic animals, but some interests have developed in raising sheep and cattle. In the summer time sea fowl are abundant, moving from the south to breed in the warmer parts of the island. Many forms of mineral products abound, among them cryolite, lignitic coal, copper, iron, graphite, asbestos, and nickel. The sun is constantly above the horizon in June and July, when the warmer season occurs, but the short summer is followed by a dark, long, and dreary winter.

Greenland is usually classed as a possession of Denmark, but the region within the Danish colony does not exceed 50,000 square miles. The Greenland Commission at Copenhagen has general charge of the administration, whose head is appointed by the crown. The colony is divided into two districts of North and South Greenland, each being under an inspector general. The trade is chiefly with Denmark. Cryolite, feathers, eiderdown, reindeer skins, and furs are the chief exports. Godthaab is the capital of South Greenland and Godhavn is the capital of the Colony and of North Greenland.



An Icelander named Gunnbjörn discovered Greenland about 876. In the 10th century Scandinavians from Iceland and Norway made settlements, and in 1264 it was united with Norway for political purposes. Two settlements, known as West Bygd and East Bygd, flourished in the 14th century, but later gradually disappeared. Danish expeditions sent for the inspection of the colonies from 1585 to 1670 were unsuccessful in finding them. The only evidence of their

former existence consists of inscriptions and numerous relics. In 1721 the Danes founded a colony, the expedition being led by Hans Egede, and it became known as Good Hope Settlement. Nansen crossed the interior from east to west in 1888, which was the first extensive interior expedition. Subsequently explorations were made by Peary and Nordenskjöld. Only 228 of the inhabitants are whites, the others being Eskimos. Population, 1921, 12,156.

GREEN MOUNTAIN BOYS, the name of a band of Vermont mountaineers who took part in the American Revolution. They were led by Ethan Allen and Benedict Arnold on May 10, 1776, when they captured Fort Ticonderoga with 50 British prisoners and 200 cannon. Other notable victories include those of Crown Point and the Battle of Bennington. They rendered efficient service throughout the Revolution.

GREEN MOUNTAINS, a range of the Appalachian system, dividing Vermont into two nearly equal portions. Mansfield is the highest peak, 4,280 feet high, and five others range over 4,000. The mountain sides are covered with fine forests of spruce and other evergreen and deciduous trees. They contain valuable deposits of gneiss, granite, slate, iron, and marble. Numerous streams have their sources in the Green Mountains, flowing through fertile valleys. The region was first settled by the patroons and others and became famous in Colonial and Revolutionary history.

GREENOCK (grēn'ŭk) a city and seaport of Scotland, in Renfrewshire, on the Firth of Clyde, eighteen miles northwest of Glasgow. It has an excellent harbor, is beautifully located along the coast, and back of it are picturesque cliffs. Among the public buildings are several educational institutions, the townhall, and several fine churches. Sugar refining and shipbuilding are the principal industries. Other manufactures include anchors, cordage, steam engines, clothing, textiles, and sails. The prosperity of the city dates from 1707, when its commerce with the West Indies and America became important. Visitors are shown the grave of Burns's "Highland Mary" and places frequented by Watt, who was born here. Greenock was a small fishing village in 1635. Population, 1921, 75,140.

GREENOUGH (grēn'ŏ), **Horatio,** sculptor, born in Boston, Mass., Sept. 6, 1805; died in Somerville, Mass., Dec. 18, 1852. He studied at Harvard and in 1825 went to Italy, where he resided the greater portion of his time. The large statue of Washington in front of the capital of the United States is his principal large work. Other productions include the "Rescue," "Venus Victri," and "Medora."

GREENOUGH, Richard Saltonstall, sculptor, brother of Horatio, born in Jamaica Plains, Mass., April 27, 1819; died April 24, 1904. He attended the Boston Latin school, studied sculpturing in Paris, and after 1874 resided mostly in Europe. Among his principal productions are the bronze statue of Franklin at city hall square in Boston, "Boy and the Eagle," "Carthaginian Woman," and a bust of Shakespeare.

GREEN RIVER, a river of the United States, rises in the Wind Range Mountains of Wyoming, and joins the Grand River to form the Colorado. From the western part of Wyoming it flows in a general direction toward the south, passing through a small part of northwestern Colorado and joining the Grand River in southeastern Utah. Green River, Wyoming, is the principal town on its banks. It has a length of about 500 miles, the greater part of its course being through deep and rugged canyons.

GREEN RIVER, a river of the United States, rises in Lincoln County, near the central part of Kentucky, and flows into the Ohio about six miles above Evansville, Ind. The Echo River of the Mammoth Cave is a subterranean affluent of the Green River. The lower valley of the Green River has vast coal deposits and its upper course is through a region of limestone. It is about 300 miles long and the construction of dams and locks have made it navigable nearly 200 miles.

GREENSBORO (grēnz'bŭr-ō), a city in North Carolina, county seat of Guilford County, about eighty miles northwest of Raleigh. It is on several motor bus lines and the Southern Railroad, and has manufactures of clothing, textiles, earthenware, cigars, hosiery, and machinery. Among the chief buildings are the public library, a State college of agriculture, Bennett College, and Greensboro College. The surrounding country produces large quantities of cereals, live stock, and fruits. It has deposits of iron and copper. Greensboro was settled in 1808 and became a city in 1870. Population, 1900, 10,035; in 1920, 19,746.

GREENSBURG, a city in Indiana, county seat of Decatur County, 45 miles southeast of Indianapolis. It is on the Cleveland, Cincinnati, Chicago and Saint Louis and other railroads. The noteworthy buildings include the county courthouse, the high school, and the State Odd Fellows' Home. It is surrounded by a fertile country and has a large trade in produce. The manufactures include clothing, furniture, flour, novelties, and machinery. The city has good municipal improvements. Population, 1900, 5,034; in 1920, 5,345.

GREENSBURG, a borough of Pennsylvania, county seat of Westmoreland County, thirty miles southeast of Pittsburg, on the Pennsylvania Railroad. The surrounding country has rich deposits of gas and coal. Among the manufactures are glass, brick, flour, engines, and hardware. It has a number of fine schools, several county buildings, and institutions for secondary education. The village of Hanna's Town, located in the vicinity, was destroyed by the Indians in 1782. Population, 1920, 15,033.

GREENVILLE, a city in Mississippi, county

seat of Washington County on the Mississippi River, 98 miles northwest of Jackson. It is on the Southern and the Yazoo and Mississippi Valley railroads. The industries include oil mills, cotton compresses, and lumber mills. It has a public park, a fine courthouse, and several large schools. Electric lights, water works, and telephones are among the improvements. Its annual shipment of cotton is very extensive. Population, 1900, 7,642; in 1920, 11,560.

GREENVILLE, county seat of Darke County, Ohio, on Greenville Creek, 35 miles northwest of Dayton. It is on the Cleveland, Cincinnati, Chicago and Saint Louis and other railroads and is surrounded by a fertile farming country. It has a Carnegie public library, a children's home, and a fine county courthouse. The manufactures include bread, furniture, and machinery. It is a grain-shipping center. A public park, waterworks, and electric lights are among the facilities. Greenville occupies the former site of an Indian village in which Tecumseh made his home. General Wayne made it his headquarters in 1794. It was incorporated in 1832. Population, 1920, 7,104.

GREENVILLE, a city in South Carolina, county seat of Greenville County, on the Reedy River, 160 miles northeast of Atlanta, Ga. The manufactures include cotton oil, cotton goods, tobacco, clothing, and machinery. It is the seat of Furman University and the Greenville Female College, both first class institutions. Other noteworthy buildings include the public library and the county courthouse. It has systems of electric street railways, electric lights, waterworks, and pavements. The surrounding country is fertile, producing large quantities of cotton, cereals, fruits, and live stock. It was settled in 1784 and incorporated in 1831. Population, 1900, 11,860; in 1920, 23,137.

GREENVILLE, a city in Texas, county seat of Hunt County, 56 miles northeast of Forth Worth, on the Kansas City Southern and other railroads. The noteworthy buildings include the high school, the county courthouse, and the Holiness and Burleson colleges. It is surrounded by a fertile region and has a large trade in farm produce and merchandise. The chief manufactures are utensils, cigars, clothing, and machinery. It has systems of waterworks, sewerage, and electric lighting. Greenville was settled in 1844 and incorporated in 1875. Population, 1900, 6,860; in 1920, 12,384.

GREENWICH (grĭn'ĭj), a borough of London, in Kent, England, situated on the south side of the Thames, about five miles southeast of London. The most important building is the Greenwich Hospital, founded in 1694 by William and Mary for the care and maintenance of British soldiers, but it was not completed until eleven years later. Its original cost was $250,000, but subsequently additions were made by which the hospital was enlarged and rendered much more serviceable. Other noteworthy buildings include the Royal Naval College, a naval museum, and the Royal Observatory. It is connected with London and other centers of population by railroads, electric car lines, and telephones. Among the enterprises are extensive rope works, shipyards, machine shops, and engineering establishments. It is the birthplace of Henry VIII. and Queen Elizabeth. Longitude is reckoned from Greenwich by English geographers, and it is made the basis of calculations by American writers in connection with the American basis, which is at Washington. Population, 1921, 95,977.

GREENWICH OBSERVATORY, an institution situated in Greenwich, England, where it was erected in a park containing 190 acres and designed for the advancement of nautical astronomy and navigation. It was founded by William III. and completed in 1705. The courses of study pursued at present fit the students either for the navy or the merchant service. This institution is one of the oldest and most celebrated observatories in the world and is equipped with all modern apparatus. From it the exact time is telegraphed to various English cities.

GREENWOOD, James M., educator, born near Springfield, Ill., Nov. 15, 1836. He attended the common schools in Illinois and removed to Missouri in 1852, where he worked on a farm and taught in the public schools. Later he studied at Canton Seminary and in 1867-74 was an instructor at the normal school in Kirksville. In the latter year he was elected superintendent of schools in Kansas City, which position he has filled with eminent success since that time. He published "Principles of Education Practically Applied" and "A History of Arithmetic, Algebra and Geometry." He died August 14, 1914.

GREENWOOD, county seat of Leflore County, Mississippi, 110 miles north of Jackson, near the Yazoo River, on the Southern and on the Yazoo and Mississippi Valley railroads. It has cotton mills, machine shops, and a large jobbing trade. The features include the courthouse, city hall, public library, and federal building. It was settled about 1860. Population, 1920, 7,793.

GREENWOOD, county seat of Greenwood County, South Carolina, 66 miles northeast of Columbia, on the Southern, the Seaboard Air Line, and other railroads. It has manufactures of cotton goods, machinery, cigars, and cotton seed oil. The features include the courthouse, Lander College, and Connie Maxwell Orphanage. Population, 1920, 8,709.

GRÉGOIRE (grā-gwär'), **Henri,** bishop and statesman, born near Lunéville, France, Dec. 4, 1750; died May 28, 1831. He studied for the church at Metz and Nancy and was made curé at Embermesnil, in Lorraine. In 1789 he was chosen one of the deputies of the clergy in the States-General and became a prominent factor in the Revolution. The church denied him the

rights of Christian burial, but the government permitted mass to be said over his body by a proscribed priest. He published "The Annals of Religion," "The Ruins of Port Royal," and "History of Religious Sects Since the Beginning of the Century."

GREGORIAN CALENDAR (grē-gō'rĭ-ạn). See **Calendar.**

GREGORY (grĕg'ō-rĭ), the name of sixteen popes, who reigned between 590 and 1846, and among whom are included many of much ability and devotion to the Christian cause. See **Pope.**

GREGORY I., Pope of Rome, called The Great, a saint of the Roman Catholic Church, was born in Rome about the middle of the 6th century and died March 12, 604. He is descended from an illustrious Roman family. At an early age he became praetor of Rome under favor of the Emperor Justin II., and after a brief period entered a monastery. When the conquering armies of Rome brought Anglo-Saxon youths to the slave market, he was imbued with a desire to enter upon a commission with the view of Christianizing their country, and accordingly set out upon that important commission. Soon after he was recalled by Pope Benedict, and later secured an important appointment at Constantinople under Pelagius II. At the death of the latter Gregory was consecrated Pope, Sept. 3, 590, in which office he revised the church ritual, advanced organization, Christianized Britain and Spain, and extended the sphere of Christian influence to many countries adjacent to Italy. Pope Gregory was noted for his liberality in bestowing gifts upon the poor, exemplifying Christian virtues, and suppressing the slave trade in many regions.

GREGORY VII., the most celebrated Pope of the Middle Ages, born in Soano, a village in Tuscany, Italy, about 1020; died in Salermo, May 25, 1085. His family name was Hildebrand and he was of German descent, but received his education in a Roman monastery in Italy. He afterward became a monk of Cluny, in France. After entering the court of Henry III. and obtaining a reputation for remarkable eloquence, he returned to Rome and became a chaplain to Gregory VI. In 1049 he was made cardinal by Leo IX., and exercised much influence under the German popes, Victor II., Stephen IX., Benedict X., and Alexander II., not only stimulating the government of the church, but developing a theory conducive to the successful reign of the Papacy. He was unanimously elected to succeed Alexander II., and received the papal crown on July 10, 1073. His reign was marked by opposition to the system of investiture and by opposing the removal of several bishops, on account of which he became involved in serious difficulties with Henry IV. of Germany. When that sovereign issued an order removing Gregory from office, the latter excommunicated him, requiring the emperor to undergo severe humiliation before the ban was removed. Later Henry made a second declaration deposing Gregory, appointed Guibert, Archbishop of Ravenna, as Pope Clement III., and took forcible possession of Rome in 1084. However, he was afterward driven from the city by an army under command of Robert Guiscard, Norman Duke of Apulia. During the severe military contest Rome was put into a state of ruin, on account of which Gregory was compelled to settle in Salerno. Gregory VII. is reputed as a man who loved justice and hated iniquity, but there are evidences that he treated his opponents with severity. The historian Milman regards him as a prolific benefactor of mankind.

GREGORY XIII., Roman Pope, born in Bologna, Italy, Jan. 7, 1502; died April 10, 1585. He was educated in Bologna, and, after teaching law there several years, was created cardinal in 1564. In 1572 he was elected Pope to succeed Pius V. He became known as a patron of learning and as a student of the sciences. In 1582 he reformed the calendar and prepared the Gregorian Calendar, according to which the Gregorian year is reckoned.

GREGORY, Casper René, clergyman, born in Philadelphia, Pa., Nov. 6, 1846. In 1864 he completed a course by graduation at the University of Pennsylvania, and later studied at Princeton Theological Seminary. He was granted a degree at Leipzig in 1876, and while there aided in biblical criticism and made a revision of some work in philology that had been commenced by L. F. C. Thischendorf. In 1890 he was made honorary professor in the University of Leipzig, being one of the few Americans who have held positions as instructors in universities in Germany. Besides contributing to various periodicals and aiding Dr. Charles Hodge in editorial work on "Systematic Theology," he translated extensively and published a number of pamphlets and reports.

GREGORY OF TOURS, historian, born in Auvergne, France, Nov. 30, 538; died Nov. 17, 594. He descended from a noble Roman family, was converted to Christianity at an early age, and in 573 became Bishop of Tours. Later he was consecrated Archbishop of Rheims. In 580 he was summoned before a council of bishops on a charge of treasonable action, mainly on account of his opposition to King Chilperic and Queen Fredegunda of Neustria, but he was acquitted and gained the confidence of Chilperic by his vigorous defense. His writings are chiefly in the Latin, but contain many interpolations from the barbarian languages. Among the chief works is "A History of the Franks," a work in ten volumes.

GREGORY THAUMATURGUS, Saint, churchman, born at Neocaesarea in Pontus, Asia Minor, about 210; died 270 A. D. He became a Christian in 224 and studied with Origen a number of years. In 240 he was made Bishop

of Neocaesarea. He is the author of a number of works. His biography was written by Gregory of Nyssa, a father of the Greek Church. Among his writings are "Confession of Faith" and "The Oration and Panegyric Address to Origen."

GREGORY, Thomas Watt, public man, born in Crawfordsville, Mass., Nov. 6, 1861. He studied law and was admitted to the bar of Texas in 1885. After serving in several local offices, he was assistant attorney-general of Texas and later district judge. For many years he was regent of the University of Texas. President Wilson made him attorney-general of the United States in 1914, and he served until 1919.

GREIFSWALD (grīfs'wält), a city of Germany, in the province of Pomerania, three miles from the Baltic Sea. It is located on the Rick River, has railroad facilities and is the seat of the University of Greifswald. This institution was founded in 1456. It has a large foreign trade in fruit preserves, fish, machinery, and grain. Greifswald was an important member of the Hanseatic League, became a possession of Sweden in 1631, and has belonged to Prussia since 1815. Population, 1905, 23,767; in 1920, 28,678.

GRENADA (grĕn-ā'dà), an island of the West Indies, in the Windward group. It has an area of 133 square miles. The surface is mountainous, especially in the interior, where the peaks rise to a height of about 3,000 feet above the sea. The valleys and coastal regions are fertile, yielding cocoa, sugar cane, spices, and cereals. Columbus discovered Grenada in 1498 and the French colonized it in the 17th century. In 1763 it was captured by the British, but was retaken by the French in 1779. It was restored to the British in 1793 and has since been a British colonial possession. Saint George, the capital, is strongly fortified and has a fine harbor. In 1922 the island had a population of 69,784, of which the greater part was colored.

GRENADIER (grĕn-à-dēr'), the name of a class of troops distinguished by their height and fine appearance. The name was originally applied to the soldiers who threw the hand grenade, a small explosive shell filled with gunpowder and furnished with a fuse. It originated in 1594 and was employed chiefly to be thrown from parapets upon the besiegers below, and later came into use in naval service in close action. Grenadier troops continued to use the grenade until the modern musket was invented, and now the name is applied to a company of picked men attached to most European regiments.

GRENFELL (grĕn'fĕl), **George,** missionary and explorer, born in Cornwall, England, Aug. 21, 1849. He studied at the Baptist College in Bristol, and in 1874 was sent as a missionary to the Kamerun in equatorial West Africa. In 1876 he explored several remote sections of Kamerun and discovered Edra Falls. Subsequently he made an expedition through the valley of the Ubangi (Mobangi) River, a tributary to the Congo. He explored a large part of the Congo River valley in 1884-86, and published accounts that greatly modified the view held in regard to that region. In 1891 he was a delegate to the Congo Free State and aided in negotiating a boundary line between that country and Angola. The government appointed him to several important official positions. He was made a chevalier of the order of Leopold and of the Lion of Africa. He died July 1, 1906.

GRENOBLE (grĕ-nō'b'l), a city of France, capital of the department of Isère, sixty miles southeast of Lyons. It is well located on the Isère River, has transportation facilities by railways, and is surrounded by high mountains. The chief buildings include the University of Grenoble, a military school, and a public library of 170,000 volumes. The streets are finely paved and lighted, and a system of electric railways provides transportation facilities with urban and interurban points. Among the manufactures are leather, cement, liquors, gloves, and cotton and woolen goods. Anciently it was called Cularo and was fortified by the Romans, who changed its name to Gratianopolis in honor of Gratian. Population, 1923, 77,022.

GRESHAM (grĕsh'ạm), **Sir Thomas,** merchant and financier, born in London, England, in 1519; died Nov. 21, 1579. He studied at Cambridge University and was afterward apprenticed to his uncle, Sir John Gresham, an eminent London merchant. In 1551 he was employed to negotiate loans for the government of Edward VI. and later served as fiscal agent under Mary and Elizabeth. He was the first to suggest the advantage of raising loans among the subjects of the country rather than those of foreign states. He lectured extensively on scientific topics, established the first royal exchange, and founded Gresham College. However, he is best known by the discovery of the economic principle called Gresham's Law, according to which, when two forms of money are in use, the one of lesser value will drive the one of greater value out of use. This principle he applied originally to the worn, mutilated, or depreciated coinage, and later it was used with reference to the coins in which the intrinsic or bullion value is the smaller. This arises from the tendency to use the money of greater value in foreign trade, where it is received for its bullion value, while the coins of lesser value circulate at home In late years it has been applied by some writers to bimetallism, since the claim is made that silver, being the coin of lesser value, tends to drive the gold coins out of circulation.

GRESHAM, Walter Quinton, soldier and statesman, born in Harrison County, Indiana, March 17, 1832; died in Washington. D. C., May 28, 1895. After receiving a common school education, he attended the State University of Indiana, and was admitted to the bar in 1853. He was elected to the State Legislature as a

Frémont Republican in 1860. When the Civil War began, he resigned to accept a commission with the Indiana volunteers. Soon after he was promoted colonel, then brigadier general, and later major general. His services were especially gallant at Atlanta, Corinth, and Vicksburg. President Grant appointed him United States judge for the district of Indiana in 1869, which position he resigned in 1882 to enter the Cabinet of President Arthur as Postmaster-General, in which position he became distinguished as an opponent of the Louisiana Lottery. He became Secretary of the Treasury in 1884, but resigned soon after to accept the office of United States judge of the seventh circuit, which position he filled with dignity until 1893. In 1892 he supported the Democratic party, and was selected the following year by President Cleveland as Secretary of State. In this position he showed remarkable traits of statesmanship, particularly in the dispute between Venezuela and Great Britain.

GRETNA GREEN, a village in Dumfriesshire, Scotland, near the head of Solway Firth. It is famous as the place for contracting many irregular marriages. The Scotch law relating to marriage, being more liberal than that of England, caused young couples from the latter country to resort to Gretna Green to take the marriage vows. In the most widespread prevalence of this practice, about 1771, the marriages there often reached 200 per year. The marriage laws were revised in 1856, whereby those contracted at Gretna Green were invalid unless one of the contracting parties had been a resident of Scotland at least 21 days previous to the ceremony.

GRÉTRY (grā-trē'), **André Ernst Modeste,** composer, born in Liége, Belgium, Feb. 11, 1741; died Sept. 24, 1813. He was educated by private tutors and in 1759 he went to Rome, where he studied music for eight years. In 1767 he went to Paris and attained success as a composer. For forty years he enjoyed much popularity in France. His principal operas are characterized by grace and spirit, and his music is melodious and dramatic. He is considered one of the principal founders of the French comic opera. He wrote the music for Marmontel's "Le Huron." His chief production is "Guillaume Tell," which is written after the style of Schiller.

GREUZE (grēz), **Jean Baptiste,** eminent painter, born in Tournus, France, Aug. 21, 1725; died in Paris, March 21, 1805. He studied art at Lyons and afterward at the Academy in Paris. After producing several excellent works of art, he went to Italy, but returned to Paris in 1757. Among his productions are several Bible scenes and others taken from rural life that have attained a wide reputation and popularity. Among his most celebrated productions are "The Blind Man Cheated," "Father Explaining the Bible to His Children," "Girl with Doves," "The Broken Pitcher," and "Severus Reproaching Caracalla."

GRÉVY (grā-vē'), **François Paul Jules,** President of France, born in Mont-sous-Vaudrey, France, Aug. 15, 1807; died there Sept. 9, 1891. After securing a liberal education he studied law at Paris and was admitted as a lawyer in 1837. He became an advocate of republican ideas at an early age. In 1848 he was made a member of the national assembly and attained a reputation as an orator. When Louis Napoleon became emperor, he devoted himself to the practice of law and in 1868 was elected to the national assembly, where he developed strength as an opponent to the empire. He was president of the assembly in 1871-73 and again in 1876. Upon the resignation of MacMahon as president in 1879, he was chosen chief executive of the republic for seven years, and was reëlected in 1885. During his long public career he had the implicit confidence of the people, but in 1887 he was charged with partiality in the appointments to office, and, after considerable public discussion, resigned the presidency on Dec. 3, 1887.

GREY, Albert Henry George, statesman, born in England, Nov. 28, 1851; died Aug. 29, 1917. He studied at Trinity College, Cambridge, where he graduated, and in 1896 was made administrator of Rhodesia. Two years later he was made director of the British South Africa Company, serving until 1904, when he became Governor General of Canada. He served with distinction in the Anglo-Boer War, did much to extend British influence and commerce in South Africa, and administered the affairs of Canada with dignity and success. In his Canadian policy he favored a development of the military forces of Canada rather than the enlargement of the royal navy. His publications include "Hubert Hervey, a Memoir."

ALBERT HENRY GREY.

GREY, Charles, statesman, born at Falladon, England, March 15, 1764; died July 17, 1845. He was educated at King's College, Cambridge, and spent some time in traveling on the continent. In 1786 he was made a member of Parliament as a Whig, and soon became prominent as a friend of Parliamentary reform. He opposed the Irish union in 1799, succeeded Fox as Secretary of Foreign Affairs in the Grenville Cabinet, and went out of office when the min-

istry fell on account of the Catholic emancipation. In 1807 he was made Earl Grey. He incurred the displeasure of the king by opposing the persecution of Queen Caroline, but when William IV. ascended the throne, in 1830, after the retirement of the Wellington ministry, he became Premier. He resigned in 1834 and spent the remainder of his life in retirement.

GREY, Sir Edward, statesman, born in 1862. He studied at Oxford and in 1885 entered the House of Commons. In 1905 he became Secretary of Foreign Affairs, serving until 1916, when he was succeeded by Arthur J. Balfour. He was created an earl the same year. Throughout the Great European War he rendered valuable services to his country.

GREY, Lady Jane, Queen of England for nine days, born at Broadgate in October, 1537; beheaded on Towerhill, Feb. 12, 1554. Her father was Henry Grey, who subsequently became Duke of Suffolk. She received a liberal education and when sixteen years of age entered a marriage contract much against her will with Lord Guilford Dudley, the fourth son of the Duke of Northumberland. The marriage was contracted to secure the succession of the throne to the family of Northumberland and she became queen on July 9, 1553, immediately after the death of Edward VI. Nine days later she was confined as a prisoner in the Tower on a charge of treason, and a death sentence followed four months later. On the scaffold and at all times she declared her innocence of the conspiracy to usurp the throne and declared that she had no desire to be queen.

GREYHOUND. See **Dog.**

GRIEG (grēg), **Edvard Hagerup,** composer and pianist, born at Bergen, Norway, June 15, 1843; died Sept. 4, 1907. He studied at the conservatory of music in Leipzig, Germany, and later at Copenhagen. In 1865 he went to Rome and the following year took up his residence at Christiania. The government granted him a stipend to resume study at Rome in 1870, where he received encouragement from Liszt and other musicians. Soon after he obtained important engagements in England and Germany, where his music became highly popular. He has been called the Chopin of the North. His productions include violin, violoncello, and pianoforte sonatas, many songs, and several works for chorus and orchestra. His most famous production is entitled "Peer Gynt Suite."

GRIFFIN (grĭf'fĭn), or **Gryphon,** a fabulous monster of ancient India, supposed to have watched over the treasury. It is represented as half bird and half beast, and is said to have guarded the gold of the Hyperborean regions from the one-eyed Arimaspians. In fable and poetry the ancients describe it as having the head and wings of an eagle, the ears of a horse, and the body of a lion. It was common to have the figure of the griffin in heraldry.

GRIFFIN, a city in Georgia, county seat of Spalding County, forty miles south of Atlanta, on the Southern and the Central of Georgia railroads. The State Experimental Farm is near the city. It has manufactures of furniture, cigars, machinery, canned fruits, and utensils. The surrounding country produces large quantities of cotton, fruits, cereals, and live stock, thus giving it considerable trade advantages. Among the municipal improvements are waterworks, sewerage, and pavements. Population, 1900, 6,857; in 1920, 8,240.

GRIFFIS (grĭf'fĭs), **William Elliot,** author, born in Philadelphia, Pa., Sept. 17, 1843. After serving as a volunteer in the Civil War, he entered Rutgers College, from which he graduated in 1869, and subsequently studied at the New Brunswick Theological Seminary. In 1870 he was appointed by the government of Japan to establish schools on the American system, and in 1871 became superintendent of schools in the province of Echizen. He was professor of physics and chemistry at the Imperial University of Tokio for three years, and returned to the United States in 1874 to continue his studies at Union Theological Seminary in New York City. In 1886 he was made pastor of the Shawmut Congregational Church in Boston and subsequently held similar positions in Schenectady and Ithaca. Among his publications are "Japanese Fairy World," "Verbeck in Japan," "Lily Among Thorns," "Japan in History," "Folklore and Art," "Asiatic History," "Corea, the Hermit Nation," "The American in Holland," and "An Outline Study of Japan."

GRIMES, James Wilson, statesman, born in Deering, N. H., Oct. 20, 1816; died in Burlington, Iowa, Feb. 7, 1872. He graduated at Dartmouth College in 1836, began the practice of law at Burlington, Iowa, shortly after, and was elected a member of the territorial Legislature in 1838 and in 1843. In 1852 he became a member of the State Legislature, became Governor in 1854, and was elected as a Republican to the United States Senate in 1859. He was reëlected in 1865, but resigned in 1869 owing to failing health. Grimes promoted railroad building, was a mover in the Free Soil party, and aided in founding the Republican party. He was adversely criticised by his party friends for voting to acquit President Johnson. During his terms in the United States Senate he served on several committees, and was among the first to advocate the use of ironclad vessels.

GRIMM, Herman Frederick, author and dramatist, son of Wilhelm Karl Grimm, born in Cassel, Germany, Jan. 6, 1828; died June 16, 1901. He was educated at Berlin and Bonn, and accepted the chair of history and art at Berlin in 1872. In 1894 he published his lectures as a biography of Goethe. Among his general works are "Arminius," "Life of Michael Angelo," "Dreams and Awakenings," "Fifteen Essays," and "The Uncontrollable Powers."

GRIMM, Jacob Ludwig Karl, scholar and

philologist, born in Hanau, Germany, Jan. 4, 1785; died Sept. 20, 1863. He received a liberal education at Marburg, later pursued a select course of study at Paris, and became a profound student of literature. On returning to Germany, he was appointed secretary to the minister of war of Hesse-Cassel, and subsequently became librarian and auditor in important places. The elector of Hesse selected him as ambassador and with him he attended the congress of Paris and Vienna. In 1830 he became professor of German literature at the University of Göttingen, and while there de-

JACOB L. K. GRIMM. WILHELM K. GRIMM.
GRIMM BROTHERS.

voted seven years to the study of ancient languages, history, and literature. In 1841 he was made professor at Berlin, was a member of the Assembly at Frankfort in 1848, and in the meantime devoted much time and attention to literary work. Among his principal publications are "History of the German Language," "Origin of Language," "German Mythology," "Antiquities of German Laws," "Nursery and Fireside Stories," and "Dictionary of the German Language."

GRIMM, Wilhelm Karl, philologist, brother of Jacob Ludwig Grimm, born in Hanau, Feb. 24, 1786; died Dec. 16, 1859. He graduated with honors at Marburg University, filled numerous positions of honor, and was professor of philosophy at Göttingen. Later he taught with his brother at Berlin and was associated with him in many writings. Among his own publications are "Heroic Legends of Germany," "Poems of the Sixth Century," and "German Runic Characters." The Grimm brothers are among the most eminent writers, philologists, and antiquarians of the German people, and have done for that language what Worcester, Webster and Johnson did for the English. They are the originators of *Grimm's Law,* which is one of the most important of all phonetic laws. It states the changes, generally termed the first and second sound shiftings, which have been undergone by the mutes and explosives of the consonant system in use among the Teutonic languages. Their writings have been largely translated and are frequently quoted as authoritative.

GRINDING, the operation of breaking and reducing any hard substance to fine particles by friction or attrition. The process is used in various mechanical arts, such as grinding corn and wheat, and fitting for use various metals and stones. In grinding glass into facets it is generally customary to use stone lapwheels, while in grinding needles and steel pins a process called *dry grinding,* which is effected by dry grindstones, is employed. Diamond dust is used in grinding diamonds and other precious stones. Grinding is employed variously, depending upon the material to be affected by friction. The mechanical implements used are variously constructed and are propelled either by hand, steam, or electric power.

GRINDSTONE (grīnd'stōn), a sandstone disc, more or less circular, used for abrading hard substances. A horizontal axle rests upon a support on either side of the stone. The stone, in its simplest form, is rotated by means of a handle or a foot treadle, while in machine shops or factories grindstones are turned by belts or some other appliances. Grindstones are used for sharpening edged articles and in smoothing and polishing rough surfaces.

GRINNELL COLLEGE. See **Iowa College.**

GRIPPE (grĭp). See **Influenza.**

GRIQUALAND (grē'kwȧ-lănd), a region of South Africa, in Cape Colony, so named after the Griquas, a class of people that originated from native and Dutch ancestry. Griqualand East is an eastern district of Cape Colony. It has an area of 7,594 square miles and a population of 225,500, including about 5,000 whites. It has been a dependency of Cape Colony since 1875. Kokstad is the capital. Griqualand West is a northern district of Cape Colony and has an area of 15,187 square miles. In 1871 it was annexed to Cape Colony. Kimberley, the capital, is surrounded by a productive diamond-mining region. Population, 1923, 84,278.

GRISI (grē'sē), **Giulia,** noted singer, born in Milan, Italy, May 22, 1812; died in Berlin, Germany, May 29, 1869. She studied at Milan and Bologna and made her first public appearance in 1827. In 1828 she took part as *Emma* in Rossini's "Zelmira" at Bologna, where she met with an enthusiastic reception. In 1854 she and her husband, Signor Mario, visited the United States and Canada and later she appeared in England, Germany, France, and other European countries. The rare melody and sweetness of her voice won distinction and admiration, while her personal grace and beauty caused the public to admire her in expressions of delight. Heine and several other masters wrote of her in an approving manner. Among her favorite rôles were *Emma* in "Zelmira," *Norma, Don Pasquale,* and *I Puritani.*

GRISTLE (grĭs"l). See **Cartilage.**

GRISWOLD (grĭz'wŭld), **Rufus Wilmot,** author, born in Benson, Vt., Feb. 15, 1815; died in New York City, Aug. 27, 1857. After securing a general education, he traveled in the United States and Europe, but later became printer, journalist, and Baptist minister. Besides being one of the editors of the works of Edgar A. Poe, he wrote "Poets and Poetry of America," "Female Poetry of America," "Curiosities of American Literature," "Washington and the Generals of the Revolution," and "Sacred Poets of England and America."

GRODNO (grôd'nŏ), a city of Poland, capital of the government of Grodno, 160 miles northeast of Warsaw. It is located on the Niemen River, has extensive railroad facilities, and is surrounded by a fertile region. The city is not well built, but it has a large trade in merchandise and grain. Among the manufactures are soap, tobacco, paper, pottery, and machinery. In 1793 it was the seat of a conference that agreed upon the partition of Poland, and it became a part of Russia two years later. It was occupied by the French in 1812 and by the Germans in 1915. Population, 1922, 52,290.

GRONINGEN (grō'nĭn-gĕn), a city and port of the Netherlands, capital of a province of the same name, on the Hunse River, 92 miles northeast of Amsterdam. It is connected by several railroads and has canal facilities through the Hunse and the Aa rivers, by means of which large vessels reach the city. Among the important buildings are a beautiful Gothic church with a tower 345 feet high, a university founded in 1640, and several government buildings. It has an observatory, a museum of natural history, an academy of architecture and navigation, and a library of 95,000 volumes. Many electric railway lines furnish communication to suburban and interurban localities. Among the manufactures are ships, soap, white lead, paper, clothing, furniture, and machinery. Extensive dikes protect it against the encroachments of the sea, while substantial fortifications make it an important strategic point. Groningen dates from the 11th century, when it was known as Villa Cruoninga. Population, 1917, 76,282.

GROS (grô), **Antoine Jean,** historical painter, born in Paris, France, March 16, 1771; died June 27, 1835. He studied art in Paris until 1793, when he visited Italy, and soon after was appointed to a military position by Napoleon. This enabled him to acquire knowledge for the battle scenes painted by him, and for which he was placed at the head of the painters of France. In 1804 he completed his famous painting which represents Napoleon administering to the sick, entitled "Plague at Jaffa." His chief work is considered to be the "Cupola of Saint Genevieve" at Paris, exhibiting the saint protecting the throne of France, represented by Clovis, Charlemagne, Saint Louis, and Louis XVIII. It is correct in design and covers a large space, but the coloring is defective. For it the artist received the title of baron and a large sum of money. Among his paintings are "Battle of Wagram," "Battle of Aboukir," "Battle of the Pyramids," and "Napoleon Visiting the Field of Eylau."

GROSBEAK (grōs'bēk), the general name of a number of birds, especially those that have a large bill of sufficient strength to break the stones of olives, cherries, and other fruit. The common grosbeak of North America winters in the southern part of the United States and breeds as far north as Maine and Manitoba. It is a favorite bird of song, has a rose-red breast, and is commonly called the *rose-breasted grosbeak.* The pine grosbeak breds far north in Canada and winters in the latitude of Washington, D. C., and southward. Other species include those known as the *blue grosbeak,* the *evening grosbeak,* and the *black-headed grosbeak.* Birds of this class belong to the finch family and the hawkfinches. The *hawkfinch* of England is usually classed as a grosbeak.

GROSSWARDEIN (grōs'vär-dīn), or **Nagyvarad,** a city of Hungary, capital of the county of Bihar, 36 miles southeast of Debreczin. It is situated in a beautiful plain, has railroad facilities, and is notable as a miltary center. The buildings include a number of fine cathedrals, the Church of Saint Ladislas, and several educational institutions. Among the manufactures are pottery, wine, starch, liquors, machinery, and earthenware. Electric lights and street railways, stone and asphalt paving, and waterworks are among the public utilities. The sulphur springs of Hajó are six miles south of the city. Population, 1922, 49,508.

GROSVENOR (grō'vẹ-nẽr), **Charles Henry,** statesman, born at Pomfret, Conn., Sept. 20, 1833. At the age of five years he removed to Ohio, where he attended the public schools and later became a teacher. He was admitted to the bar in 1857, established a successful practice, and served throughout the Civil War in the Union army. In 1865 he was mustered out of the service with the rank of brigadier general and again took up the practice of law. He was elected to the State Legislature as a Republican in 1874 and was elected to Congress in 1884 serving continuously for six years. He was again elected to Congress in 1892 and was twice reëlected. During his service in Congress he was a member of many important committees and had a reputation as a conservative member of his party. He died Oct. 30, 1917.

GROTE (grōt), **George,** historian and philosopher, born in Kent, England, Nov. 17, 1794; died June 18, 1871. He was educated at the Charterhouse school, entered his father's bank at sixteen, but during leisure hours devoted himself to a diligent study of literature and history. He began early to collect material for a history of Greece, and in 1832 completed several able productions on parliamentary reform. In the

same year he entered Parliament as a Liberal in politics. His career as a legislator was distinguished by speeches delivered with much effect and particularly by his advocacy of voting by ballot. He was twice reëlected to Parliament and in 1843 retired from the banking house for the purpose of devoting himself to his "History of Greece." This work consists of twelve volumes, the first two volumes appearing in 1846 and the last volume in 1856. The enthusiastic reception given to this production led him to publish a work on Plato in 1865. Later he began a work on the life of Aristotle, but did not succeed in completing it, though the portion completed was published after his death. He was president of University College and vice chancellor of London University for many years, and spent much time in the management of these institutions. Grote was a man of liberal opinions and studious research. His work on history takes high rank for its general accuracy and on account of its strong points in philosophy and logic.

GROTIUS (grō'shĭ-ŭs), or **De Groot, Hugo,** scholar and historian, born in Delft, Holland, April 10, 1583; died in Rostock, Aug. 28, 1645. He descended from influential ancestors, was educated at the University of Leyden, and after receiving a degree accompanied Olden Barneveldt on an embassy to France, where he secured the friendship of Henry IV. After practicing law in his native country, he secured a government appointment at Rotterdam in 1613, and later went to Sweden, where Queen Christina appointed him ambassador to France in 1635, which position he held ten years. His writings are largely historical and political, the most important being devoted to fundamental principles of international law. This work is entitled "De Jure Belli et Pacis."

GROUCHY (grōō-shē'), **Emmanuel, Marquis of,** general, born in Paris, France, Oct. 23, 1766; died in Saint Etiénne, May 29, 1847. At the age of fourteen years he entered the army. When the Revolution broke out he was made colonel of cavalry, and distinguished himself by assisting in suppressing the revolt in La Vendée. In 1798 he fought under Moreau in Italy, where he was taken prisoner, but was exchanged the following year. Shortly after he fought successfully at Hohenlinden, Eylau, Friedland, and Wagram, and was in command of Napoleon's bodyguard from Moscow. After the return of Napoleon from Elba, he was made marshal of France, in which position he defeated Blücher at Ligny. He was criticised adversely for complying strictly with the orders of Napoleon directing him not to march to Waterloo, hence he was absent from that battle and was held indirectly responsible for Napoleon's defeat. He was banished after Napoleon's second abdication, came to America, and for six years resided in Philadelphia. A royal ordinance in 1821 permitted his return to France, and in 1832 he was created peer with the title of marshal.

GROUND HOG. See **Woodchuck.**

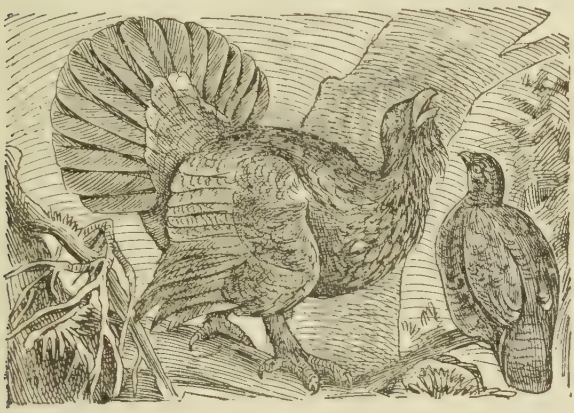
GROUND SQUIRREL, the name of a class of rodent mammals intermediate in character between the marmots and the true squirrel. The common ground squirrel has short legs and a slender body and lives chiefly on or in the ground. It is an active and restless animal, has longitudinal stripes on the back and sides, and emits a peculiar chirping sound when calling its mate. The *chipmunk* belongs to the ground squirrels. Other species are the *flickertail* of North Dakota and Saskatchewan and the *striped gopher* of the northwest. The *pocket gopher* has peculiar pouches on the sides of the head and is troublesome in piling up mounds in the meadows. Allied species are found in Asia and other continents.

GROUSE, the common name of various game birds abundant in the northern sections of both hemispheres, belonging to the group of gallinaceous birds, distinguished by a naked band in place of an eyebrow. They are characterized by their plump bodies and the feet, legs, and nostrils are covered more or less with feathers. In many species a loose, bare sac is suspended on each side of the neck. They are the most delicate game birds that come to the table. Among the different species are found the ptarmigan, red grouse, ruffed grouse, pinnated grouse, and sage hen. To the same family belong the quail and various domestic fowls, including the cock and hen, turkey, guinea fowl, and peacock.

The *ptarmigan* is a species native to the Arctic regions, whose plumage in winter is snow-white. It somewhat resembles the red grouse, sometimes called the *European ptarmigan,* which is found in Scotland and does not turn white in winter. The *ruffed grouse* is common to America. It is known in the eastern states as pheasant, farther west as partridge, and in the western states by its proper name—*grouse.* This species prefers to frequent timber and brushy lands, is shy and quick in movement, and the color is closely adapted to the gray of the underbrush. A distinguishing habit of the male is a drumming sound, made while standing upright, by strokes of the wings upon the earth or some hard substance with such rapidity and strength as to be heard at a considerable distance.

Several species closely allied to the ruffed grouse are found in Eurasia, but do not drum. The pinnated grouse, or *prairie chicken,* inhabits the central and western plains and is protected by the laws of the states, except for a short period in the fall of the year. The *oom-oom-boo* produced by the male in the breeding season is well known to hunters, and is made by means of the large, orangelike sacs on its neck. These sacs are covered with long, winglike tufts of feathers, which, when booming, stand up like

ears, giving it a peculiar appearance. In size the prairie chicken is equal to the common hen and has a speckled-grayish color. The *sage hen* is the largest American grouse and is found principally on the western plains of Canada and the United States, especially in the arid regions of the Rocky Mountains. It lives on wild sage, which renders it inferior for food to other members of the grouse family.



GROUSE.

Male. Female.

GROW, Galusha Aaron, lawyer and statesman, born in Ashford, Conn., Aug. 31, 1824; died March 31, 1907. In 1844 he graduated at Amherst College, was admitted to the bar in 1847, and in 1851 became a member of Congress from Pennsylvania, serving twelve years successively. Though elected as a Democrat, he severed his connection with that party in 1854 on the repeal of the Missouri Compromise. He was speaker of the House in 1861-63, and served as a delegate to the national conventions held by the Republicans in 1864 and 1868. In 1900 he was elected Congressman at large from Pennsylvania, but retired from public service in 1903. He entered the House of Representatives as the youngest member in 1851, when Clay was in the Senate and Webster was Secretary of State. He was long "Father of the House," a term applied to the member having served longest, or a greater period than any other Congressman.

GRÜNBERG (grün'bĕrg), a city of Germany, in the province of Silesia, thirty miles northwest of Glogau. It is located on a tributary of the Oder and has convenient railway facilities. The surrounding country is noted for its extensive production of grapes and other fruits. Among the manufactures are wine, flour, yarn, clothing, and machinery. Population, 1922, 21,630.

GUADALAJARA (gwä-thä-là-hä'rà), a city in Mexico, capital of the state of Jalisco, the second city of the republic. It is situated in the fertile valley of the Rio de Santiago, about 280 miles from the city of Mexico, and ranks as an important manufacturing and commercial center. The streets are regularly platted and well paved with stone and asphalt. The most important buildings include a government mint, the cathedral, several convents, and the university. Among the manufactures are pottery, paper, jewelry, cotton and woolen goods, leather, and machinery. It has good railroad and electric railway facilities. The city was founded in 1530. Population, 1920, 118,799.

GUADALQUIVIR (gą-dàl-kwĭv'ẽr), the largest and most important river of Spain, rises near the frontiers of Murcia. It has a general course toward the southwest, flowing into the Atlantic north of Cadiz. Its length is 375 miles, of which 85 miles, or from the sea to the city of Seville, are navigable by large vessels. It has been improved by canals and jetties and is noted for its production of fish.

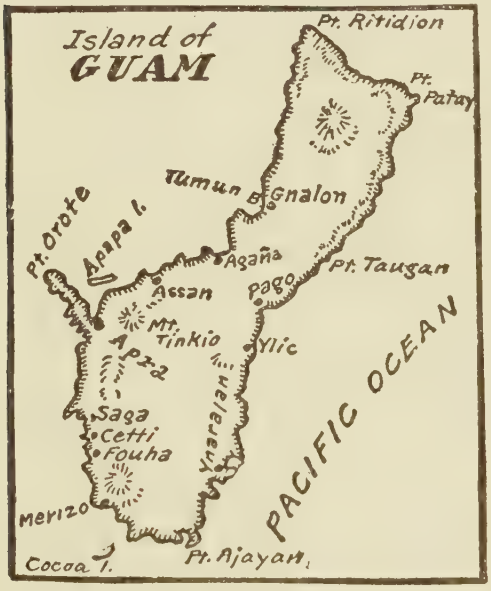
GUADALUPE HIDALGO (gwä-thà-lo͞o'på ê-thäl'gô), **Treaty of,** a treaty concluded between Mexico and the United States at the conclusion of the Mexican War. It was negotiated at Guadalupe Hidalgo, a small town near the city of Mexico, on Feb. 2, 1848. The Senate ratified the treaty on March 16th and the ratifications were exchanged the following May. By the terms of the treaty Texas, New Mexico, and Upper California were ceded by Mexico to the United States and the Rio Grande was fixed as the boundary between Texas and Mexico. The United States assured protection to the Mexicans and their property within the ceded territory, assumed the payment of claims of American citizens against Mexico in the amount of $3,250,000, and agreed to pay Mexico $15,000,000.

GUADELOUPE (gą-dą-lo͞op'), a colonial possession of France in the Lesser Antilles, consisting of two islands, Grande Terre and Basse Terre, which are separated by a narrow channel called Rivière Salée, meaning Salt River. The colony, together with five small dependent islands, has an area of 688 square miles. Basse Terre is the larger of the two main islands, having a length of 27 miles and a breadth of 15 miles; while Grande Terre is 29 miles long and about 10 miles wide. The islands are of volcanic formation, but in several regions of the group are large tracts constructed by corals. The climate is marked by humid atmosphere, gènerally hot and unhealthful, and the soil is fertile. Among the principal exports are tobacco, sugar, coffee, pepper, dye and cabinet woods, cacao, and a large variety of tropical fruits. The imports consist of machinery, fabrics, and various implements. Most of the trade is with France. In 1897 the islands were disturbed by destructive earthquakes and in 1899 by a disastrous hurricane. Basse Terre is the capital and Pointe-à-Pitre is the chief commer-

cial center. A senator and two deputies represent the colony in the chambers at Paris. Columbus discovered these islands in 1493 and they were colonized by the French in 1635. They belonged to England and France at different times, but have been French territory since 1814. Population, 1922, 183,108.

GUADIANA (gwä-thē-ā'nä), a river of the Iberian peninsula. It rises in New Castile, Spain, has a general course toward the west until it enters Portugal at Monsaras, and thence flows south into the Atlantic. Its entire course is 520 miles, but the navigable portion is only about 40 miles. The Ardilla and Giguela are its chief tributaries.

GUAM (gwäm), an island in the Pacific Ocean, the largest of the Ladrone Islands, situated about 1,500 miles east of Manila. It has an area of 190 square miles. Guam is thirty miles long and from two to twelve miles wide. It has a mountainous surface, but the soil is fertile, producing rice, indigo, sugar cane, and fruits. Agaña, situated on Agaña Bay, is the



capital and contains more than half of the population of the island. This possession is of little importance except as a port of transit and as a naval station, for which purpose the harbor of Apra has been improved, but the principal station is at the capital.

The inhabitants consist chiefly of Chamorros intermixed with Malays and Tagalos, and they engage largely in fishing and agriculture. Domestic animals were imported by the Spaniards, who introduced the cultivation of rice, fruits, and vegetables. Sugar and indigo are produced to some extent, and the climate is generally favorable and healthful. Since 1898 Guam has belonged to the United States, having been captured by the cruiser *Charleston* in the Spanish-American War and ceded by the Treaty of Paris. It is governed by a naval officer acting under the direction of the Secretary of the Navy. Important reforms were instituted by Captain Leary, the first governor, and the present policy is to encourage agriculture, restrict the sale of intoxicating liquors, and extend education among the natives. Population, 1922, 13,798.

GUAN (gwän), a bird of Central and South America, where it is found both wild and domesticated. It belongs to the same family as the curassow and in many respects is similar to the grouse and partridge. The color is dark brown or black, marked with green and white, and the throat is wattled and nearly bare. Some of the species have the head crested. The tail and wings are quite long in all the species. These birds are seen in flocks most of the year, but during the breeding season separate into pairs, and incline to live a considerable part of the time in the high forest trees. The guan, or *chachalaca,* of North America, is found in the valley of the lower Rio Grande, both in Texas and Mexico. It is about two feet long, has a glossy grooved tail, and the general color is dark brown with lighter shades below. It builds its nests on the ground, in bushes, or in the limbs of trees.

GUANABACOA (gwä-nä-vä-kō'ä), an important suburban town of Cuba, situated about four miles east of Havana, with which it has railroad and telephone connections. It is noted for its beautiful gardens, parks, and hot and and cold baths for invalids. The streets are regularly platted and many of its buildings are of good material and on modern plans. Population, 1907, 21,805; in 1921, 27,544.

GUANACO (gwä-nä'kō), a kind of llama found in various parts of South America, especially on the plains of Patagonia and the highlands of Peru and Ecuador. It is somewhat smaller than the alpaca and llama, which are the domesticated species. The height at the shoulders is about four feet. It has slender legs. The flesh and skin are valuable. It can be easily domesticated, in which state it furnishes milk and flesh for food, and wool and skin for clothing. It is greatly improved by domestication and artificial breeding.

GUANAJUATO (gwä-nä-hwä'tō), a city of southern Mexico, capital of the state of Guanajuato, situated among mountain ranges which are 6,780 feet above sea level. The streets are irregular, but many of the buildings are substantial and modern. It is connected with other cities by railroads, surrounded by one of the richest mineral countries in the world, and has manufactures of implements, clothing, machinery, jewelry, and fabrics. The institutions include several public schools, convents, and churches. Guanajuato was founded by the Spaniards in 1554 and became a city in 1741. Population, 1920, 35,147.

GUANO (gwä'nō), the decomposed excrement of fish-eating sea birds, intermixed with the remains of seals and sea fowls. It has accumulated to the depth of eighty to a hundred feet on the Chincha Islands and the coasts of Peru and Chile. For centuries innumerable flocks of sea birds have bred and roosted on these shores, thus causing the deposits. Its value for fertilizing has been known in Peru for centuries, but it was not transported to other countries as a commercial fertilizer until 1846. Eight million tons were taken from the Chincha Islands in 1853-72. Guano contains nearly all the inorganic matter required by plants and, therefore, is one of the best fertilizing agents for the different crops. It has been found in greater or less quantities in various places, but Peru still remains the chief source of supply. However, the available quantity there and elsewhere is becoming considerably limited. The Chilean government has control of the business, which for a number of years has proved a lucrative enterprise. The principal supply of guano used in the United States and Canada is now produced at slaughterhouses from refuse flesh and blood, called *flesh guano* and *blood guano,* and at the fisheries from refuse of edible fish or from undesirable species. The menhaden are utilized largely for this purpose, though the oil is extracted before the fish are converted into fertilizer. Another class of this product, known as *bat-guano,* is obtained in caves from the manure and remains of bats.

GUAPORÉ (gwä-pō'rā), or **Itenez,** a navigable river of South America, which at its confluence with the Mamoré forms the Madeira. It rises in the province of Matto Grasso, Brazil, forms a portion of the boundary between Brazil and Bolivia, and has a total length of 950 miles.

GUARANTEE (găr-ăn-tē'), or **Guaranty,** a promise or contract to be responsible for the payment of a debt or the performance of an obligation of another. In most countries a verbal promise to assume the debt of another is not binding in law, although it implies a moral obligation, and a valid agreement to answer for the default of another is made legally binding only by a written agreement. Such a contract should state definitely the obligation or extent of liability assumed, since a guarantor can be held only to the extent expressed in the written instrument. The business of guaranteeing risks of others is an important commercial enterprise. It differs materially from the risks taken by insurance companies, since it is based upon the ability of a contracting party to perform certain definitely stated obligations. However, experience has demonstrated that it is less hazardous than the business of insurance companies.

GUARDAFUI (gwär-dä-fwē'), **Cape,** a point of land in Africa, next to Ras Hafun the most eastern point of that continent. The southeastern shore is washed by the Indian Ocean and the northwestern by the Gulf of Aden. It forms the headland of an immense promontory.

GUARDIAN (gärd'ī-ăn), in law, one who has the care and management of the person or property of another. Guardians are appointed by the judge of a court or some other qualified officer prescribed by law, and are intrusted with the care and management of those incapable of directing their own affairs, such as a minor child, a person of unsound mind, a drunkard, or a spendthrift. A person appointed to such a duty must account for all the profits as well as the estate of his ward, whose money can be invested only by the order of the court. It is incumbent upon him to provide for the maintenance and education of a minor ward, but all the estate and profits must be used judiciously, for which the guardian is required to give a good and sufficient bond. When a ward attains majority, the guardianship ceases. Guardians appointed to look after the interests of drunkards, spendthrifts, or persons of unsound mind continue to act under the direction of the court as long as their services are required.

GUATEMALA (gä-tĕ-mä'lä), the most northwesterly republic of Central America, bounded on the west and north by Mexico; east by British Honduras, the Gulf of Honduras, Honduras, and Salvador; and south largely by the Pacific Ocean. It has an area of 48,225 square miles. The surface is largely mountainous and elevated, the principal mountain chains being a continuation of the Andes. They trend from northwest to southeast, sending off a number of irregular branches. Among the mountains are numerous volcanoes, of which several are active, the most noted being Fuego, 12,075 feet high, and Agua, 14,875 feet. The drainage is in various directions, though mostly toward the east and north. Among the important rivers are the Belize, Dulce, and Motagua, which flow into the Gulf of Honduras, and several tributaries of the Usumacinta, a river system whose waters flow into the Gulf of Campeche.

Productions. Agriculture and stock raising are the principal occupations. The fertile and productive districts are largely in the valleys and along the coast, where diversified farming is carried on successfully. Cattle, sheep, mules, horses, and swine are reared profitably. Among the products are tobacco, cacao, maize, wheat, coffee, and many species of tropical fruits. The forests are abundant, yielding quantities of valuable building material, rubber, and fiber products. The minerals are numerous and occur in rich deposits, though mining has not yet developed exceedingly. Among the principal products are sulphur, tin, lead, salt, copper, silver, and gold. Manufacturing has received encouragement from the government, especially the rubber industry. Among the general manufactures are cotton and woolen goods, ironware, earthenware, sugar, cordage, furniture, beverages, and utensils. Much of the traffic former-

ly carried on by pack mules is being brought to seacoast points by railroads. The principal railroad line connects Santo Tomás, on the Bay of Honduras, with San José, on the Pacific, passing through the capital city and being connected by branch lines in various directions. In 1916 the country had 550 miles of railroads in operation, but the lines were owned by German and American companies. The highways are generally good, while several canals have been cut for the improvement of river navigation.

Government and Inhabitants. The government of Guatemala is republican in form, of which the president is the chief executive, holding office for six years. He is assisted by a cabinet of advisers, who include the heads of the six departments of foreign affairs, justice, war, public credit, interior, and public instruction. The national assembly of a single chamber is the chief legislative body, the members of which hold office four years and are elected by popular vote. A supreme court and a well-organized system of inferior courts constitute the judicial branch. The army consists of 56,000 men, but the standing army disciplined for immediate service includes only 7,000. Roman Catholic is the dominant religion, but all forms of religious worship are unrestricted and no state church is recognized. Education is free and school attendance is compulsory. The school system includes elementary and high schools, normal schools, industrial schools, and several universities. About one-third of the inhabitants are Europeans and various classes of mixed descent, while the Indian races include Aztecs, Mayas, and Toltecs. Spanish is the official language, though some of the natives retain their own distinct tongues, which are fast giving way to the general language under a system of public education.

Guatemala ranks as one of the most progressive countries of Central America, due largely to its growth in wealth and the development of its cities. Guatemala, situated about eighty miles from the Pacific, is the capital. Other cities include Cobán, Mazatenango, San Pedro, Santo Tomás, Zacapa, and Quezaltenango. Population, 1921, 1,992,042.

History. The history of Guatemala dates from 1524, when it was conquered by Cortez. After three centuries of Spanish dominion, the country declared its independence and a confederation was formed in 1821, which administered the government successfully for eighteen years. Rafael Carrera, a native Indian, conquered the country in 1839 and ruled until 1865. After his death the country was organized under a constitution modeled after that of the United States, and from that time dates its greatest progress and prosperity. Insurrections have occurred at various times, but they have been successfully suppressed. In 1918 the country declared war against Germany.

GUATEMALA, a city of Central America, capital of the republic of Guatemala, about eighty miles east of the Pacific, on an elevation 4,975 feet above sea level. The streets are platted regularly and are paved and drained. It contains several excellent government buildings, a fine cathedral, a university, an archbishop's palace, and numerous modern municipal facilities. Among its manufactures are pottery, woolen and cotton textiles, machinery, utensils, cigars, spirituous beverages, embroidery, furniture, and jewelry. In 1774 it became the capital, at which time Old Guatemala, situated some distance to the southeast, was destroyed by an earthquake. It has railroad connections with the coast, both east and west, and with many interior towns. The public school system is well organized and numerous periodicals and scientific societies are maintained. It has an extensive system of electric railways. The city was first founded in 1524, but it was twice destroyed by earthquakes, hence the present city dates from 1773. Population, 1921, 120,328.

GUAVA (gwä'vȧ), the common name of many small tropical trees found in Asia and America. The larger number of these trees are native to the tropics of America, but the more useful species have been widely acclimated in the warm climates. They yield important dessert fruits, which are fleshy and have the shape of apples or pears. The lemon guava attains a height of twenty feet, has white fragrant flowers, and yields fruit about the size of a hen's egg. The fruit is exported or used in making jelly. Another species, the red guava, is cultivated extensively in the West Indies. The strawberry guava produces small fruit of excellent flavor.

GUAVIARE (gwä-vê-ä'rȧ), a river of South America, rises in the Andes near Bogotá, Colombia, and flows eastward into the Orinoco. The basin of the Guaviare is largely a level country, but it is very sparsely settled. The river has a length of 700 miles and the greater part of it is navigable.

GUAYAQUIL (ḡwī-ȧ-kēl'), a seaport city of Ecuador, capital of the province of Guayas, on the Guayaquil River, about forty miles from the Gulf of Guayaquil. The site is on low and moist ground, on account of which fevers are common. The noteworthy buildings include a national university, several hospitals, the government buildings, and a number of churches. It has a fine harbor on the river, which is two miles wide at this point, and has extensive railroad connections with interior mining and trading centers. As a port city it is one of the best on the west coast of South America, the principal exports being coffee, cacoa, fruits, timber, nuts, India rubber, and mineral products. It has a considerable trade in ivory, live stock, tobacco, and drug materials. A waterworks system and a tramway are among the municipal improvements. It was founded in 1535 and owes its prosperity to its extensive shipping facilities.

In 1896 damage to the amount of $30,000,000 was done by fire. Severe disturbances by earthquake shocks have also destroyed portions of the city at various times. Population, 1923, 78,642.

GUDGEON (gŭj'ŭn), a fish found in the fresh-water lakes and streams of central and temperate Europe. It has a lengthened and rounded body, short dorsal and anal fins, and a labial barbel at each corner of the mouth. The head is flattened, the snout is obtuse, and the lower jaw is somewhat the shorter. It has no teeth in either jaw, but triangular bones near the entrance of the throat serve to grind the food. The gudgeon is a small fish, measuring from five to six inches in length, but it is prized for its fine flavor. A species of gudgeon about five inches long is found in the Niagara River, while five species occur in Europe.

GUELPH (gwĕlf), a city in Ontario, county seat of Wellington County, on the Speed River. It is on the Canadian Pacific and the Canadian National railways and is important as an inland port of entry. The noteworthy buildings include the Ontario Agricultural College, the public library, the high school, and the county buildings. Extensive water power is obtained from a fall of thirty feet in the river. Among the manufactures are flour, woolen goods, sewing machines, farming implements, furniture, hosiery, motor trucks, soap, and shoes. Building stone of a fine quality is quarried in the vicinity. John Galt, the Scotch author, founded the city. Population, 1901, 11,496; in 1921, 18,128.

GUELPHS AND GHIBELLINES (gĭb'ĕllĭns), the names of two important political parties that contended for supremacy in Germany and Italy from the 11th to the 14th centuries. The party names originated from two families known as the Waiblingen and Welf, who were rival parties in the German Empire, the latter being still represented in the ruling house of England. These names sprang into existence from the Battle of Weinsberg, which occurred between Emperor Conrad of Hohenstaufen and Welf in 1140. The Welfs became known as Guelphs, receiving their chief support in the Italian cities of Bologna, Florence, Vienna, Modena, and Milan, while the Waiblingens took on the name of Ghibellines and were supported principally by the cities of Lucca, Pisa, and Arezzo. During the conflicts many of the cities and communities changed in accord with the interests peculiar to different localities. In the main the Ghibellines supported the imperial authority of Germany in Italy, while the Guelphs were in opposition. Toward the latter part of the 13th century the bitter feuds partook more of the nature of a personal warfare. After the 14th century both parties disappeared from history.

GUERNSEY (gĕrn'zĭ), the most westerly and the second largest of the Channel Islands. It is located 45 miles southwest of Cherbourg, France, and 69 miles southeast of Start Point, England. The length is nine miles, the breadth is about five miles, and the circumference is thirty miles. The surface is elevated in the southern part, where the coast is picturesque, and the northern part is level. It is the nativity of the Guernsey breed of cattle, which are noted for their rich milk. Other products include flowers, fruits, and granite. Saint Peter Port is the seat of government. The inhabitants speak a Norman-French dialect. Population, 1922, 41,037.

GUERNSEY, Egbert, physician, born in Litchfield, Conn., in 1823; died Sept. 19, 1903. In 1850 he began to practice medicine in New York City, was professor in the New York Homeopathic Medical College, and organized the Western Dispensary. He published an "Elementary School History of the United States" and edited several medical journals. His publication entitled "Domestic Practice" was translated into several languages.

GUEST, Edgar Albert, writer, born at Birmingham, England, Aug. 20, 1881. He came to the United States in 1891, attended public schools at Detroit, Mich., and became connected with the *Detroit Free Press,* in which he conducted a column of verse and humorous sketches. His writings include "A Heap o' Livin'," "Just Folks," "Over Here," "When Day Is Gone," "Rhymes of Childhood," "Path to Home," "All that Matters," and "The Passing Throng."

GUIANA (gē-ä'nà), an extensive region lying between the Amazon and Orinoco rivers, South America. It is properly divided into five divisions: Portuguese Guiana, now united with Brazil; Spanish Guiana, now connected with Venezuela; and the three European colonies of Dutch, British, and French Guiana. The entire territory has a length of 1,200 miles from east to west and a breadth of 800 miles, including an area of 690,000 square miles. However, the portions united with Venezuela and Brazil have largely lost their identity, and in modern geographies the name is applied only to the European colonies. These colonies are enclosed by Brazil, Venezuela, and the Atlantic Ocean.

Europeans first explored Guiana in 1499, but settlements were not made until 1613, when the Dutch established themselves at Essequibo. The English founded a colony at Surinam in 1650, and in 1664 the French settled at Oyapok. Following these settlements numerous conflicting claims arose, which were marked by various contests until 1803, when the history of British Guiana begins and the various possessions assumed their present geographical forms. The coast regions and valleys are exceedingly fertile, and the chief wealth consists of an exhaustless soil and many tropical products. As a whole the climate is moist and hot. The rainfall ranges from 70 to 98 inches, and the temperature varies from 75° to 90° Fahr. Within the territory are many navigable rivers, splendid tracts of forest, and rich deposits of gold, sil-

ver, iron, and other minerals, especially in the southern region of the country.

British Guiana, or Demerara, is bounded on the north by the Atlantic Ocean, east by Dutch Guiana, south by Brazil, and west by Brazil and Venezuela. The area, including a portion claimed by Venezuela, is 90,277 square miles. Ranges of mountains belonging to the Parima system trend on the eastern boundary and the Awariwa highlands characterize the southern part. The principal rivers include the Essequibo, Guyuwini, Berbice, and Corentyn, the last mentioned forming part of the eastern boundary. The principal products include live stock, tobacco, coffee, maize, indigo, rice, butter, sugar, fruits, and cereals. Gold and silver are mined in the mountain districts on the south and east. The forests are luxuriant and yield large quantities of valuable timber. Among the leading exports are fish, rice, timber, vegetables, and fruits. Several railroads and numerous telephone lines have been built, connecting the seacoast towns with the interior. The government is administered by a resident governor, who is appointed by the crown, and he is assisted by an executive council and by a court of policy. Several colleges and many public schools are maintained jointly by taxation and government grants. Georgetown is the capital and principal seaport. Other thriving cities are Hope Town and Amsterdam. The inhabitants consist of natives, Africans, mixed races, and 16,900 Europeans. Population, 1923, 306,959.

Dutch Guiana, or Surinam, a colonial possession of Holland, situated between French and British Guiana. It has a seacoast of 240 miles and an area of 46,060 square miles. The government is administered through a resident governor, council, and the colonial legislature. All the coast region and many extensive valleys are highly fertile. Ranges of the Tumuc Humac Mountains extend into the southern part from Brazil. They contain valuable deposits of gold, silver, coal, petroleum, and other minerals. The principal products are sugar, cacao, lumber, live stock, cereals, tobacco, rice, and tropical fruits. Numerous connections have been made by means of telephone, telegraph, and railroads, and schools and institutions of higher learning are maintained by government grants and taxation. The principal rivers include the Corentyn on the western boundary, the Maroni on the eastern boundary, and the Carapion, Surinam, and Coppename flowing through the interior. Its exports and imports are about equal, and the productive resources are developing rapidly. The government is administered by a governor general, who is appointed by the crown, and assisted by a council. Legislative authority is exercised by an assembly, which is constituted of four members appointed by the governor and by one member chosen for each 200 voters. The population includes many Europeans, but it is made up chiefly of Negroes and Indians. Religious liberty is granted to all classes. Paramaribo, on the Surinam River, is the capital and chief city. In 1922 the country had a population of 85,465.

French Guiana, or Cayenne, a colonial possession of France, located between the Atlantic Ocean and Dutch Guiana. The surface is largely level, though there are several ranges of mountains in the southern part. Besides the Maroni River on the western boundary, there are a number of smaller streams, among them the Sinamari and Aprouague. The total area is 46,697 square miles. Cayenne, a city of 12,000 inhabitants, is the capital. The climate is exceedingly moist and unhealthful. Pepper, cloves, nutmegs, cinnamon, fruits, timber, cereals, gold, live stock, and asphalt are the principal products. The colony has not been materially prosperous, owing to its unhealthful climate. From 1853 to 1864 it formed a penal colony of France, but since the atter date no convicts have been transported there. However, Captain Dreyfus was imprisoned on Devil's Island, which lies off the coast. The government is vested largely in a governor, who is appointed from Paris and is assisted by a privy council of seven members. The city of Cayenne contains about one-third of the population of the entire possession. It has been improved by public works and is the seat of a good public school system. Besides containing several government buildings, it is the seat of the Royal Astronomical Society's station. Population, 1922, 43,256.

GUIDO D'AREZZO (gwē'dō dä-rĕ'stō), musician, born about 995; died in 1050. Little is known of his life, but it is certain that he was well educated and became a monk of the Benedictine order. It is thought that he adapted the present musical notation to its present use. Pope John XIX. invited him to Rome and did much to spread the use of the new system of music. Later he was compelled to leave Rome on account of ill health, and the later years of his life were spent at the monastery of Pomposa. He is the author of several writings that explain his musical doctrines and the use of musical notation.

GUIDO RENI (gwē'dō rā'nē), painter of the Bolognese school, born near Bologna, Italy, Nov. 4, 1575; died there Aug. 18, 1642. After studying under Denis Calvaert, he entered the school of Lodovico Caracci at the age of twenty, and early developed much skill as a painter and designer. Many of his productions are still admired in the principal galleries of Europe. His first work on which his reputation is based is the "Coronation of the Virgin." Other celebrated productions include "Michael Vanquishing Satan," "Aurora and the Hours," "Lot and His Daughters," and "Magdalena."

GUILD (gĭld), the name of various associations that flourished in the Middle Ages, being designed to further commerce, handicrafts, and various business enterprises. These associations

were advantageous in obtaining municipal and civil liberty as against the oppression of the nobles and for mutual development and protection in the industrial arts. The German guilds of craftsmen attained the height of their influence in the 13th century, when they were empowered to defend their interests by force of arms, but a decree issued in 1240 by Emperor Frederick II. restricted them in various respects with the intention of destroying further growth in political power. This decree and others issued subsequently were inoperative, and the guilds remained influential in Germany until the beginning of the 19th century, when the practice of all trades became unrestricted in all German states. Austria established freedom of the trades in 1860. The guilds secured a foothold in England early in the 7th century, remaining powerful factors in the trades and arts until Henry VIII. issued a decree confiscating their property. However, they were maintained in a general way until 1835, when every form of restriction on the trades and arts was abolished and since then various corporations have succeeded them. France and other European countries as early as 1739 took like steps for the purpose of giving all parties freedom of choice in the pursuits of trades and business enterprises. At present trades unions take the place of guilds in the matter of protecting the interest of workingmen, but they do not restrict the young in the selection of a business or occupation.

GUILFORD COURTHOUSE (gĭl'fērd), **Battle of,** an engagement of the Revolution in America, fought on March 15, 1781. Greene with an American army pursued Cornwallis after the Battle of Cowpens and joined Morgan in the Catawba Valley, and the two American forces were finally united at Guilford Courthouse, N. C. Cornwallis had an army of 2,215 veterans, while the Americans numbered 4,440. The British made a well-directed charge and at first were successful, but a regiment of Maryland troops was followed by a cavalry charge, causing the British to fall back. Cornwallis retreated toward Wilmington and abandoned the Carolinas. The Americans lost 400 and the British lost 600. This battle is considered a strategic victory for the former.

GUILLEMOT (gĭl'lĕ-mŏt), the popular name of several birds of the auks family. The common guillemot is from twelve to fifteen inches long, has almost completely black plumage, and is native to the northern parts of Europe, Asia, and America. A rare species known as the *sooty guillemot* has a white ring about the eye. The bill in all species is straight, the legs are short, and the wings are pointed. Great numbers of these birds breed in the rocky shores of the northern coasts, where their eggs are hunted for the market. The feathers are used for making clothing by the natives, who eat their flesh and eggs.

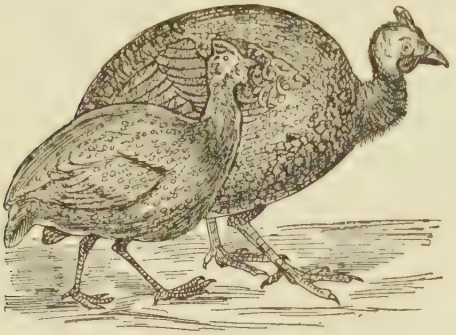
GUILLOTINE (gĭl'lŏ-tēn), an apparatus named from its supposed inventor, Joseph Ignace Guillotin (1738-1814), and used by the French government for executing criminals. A similar invention for beheading was used in the Middle Ages, but the form adopted by the convention at the time of the French revolution contained a number of improvements. A highwayman was executed on April 25, 1792, at the Place de Grede, Paris, being the first to be guillotined. The common guillotine consists of two posts placed upright on a platform about twelve feet square, between which an ax is suspended. In the ordinary guillotine the ax is formed much like a hay knife, running in grooves between the posts, where it is suspended by a loop in the halyards, and held in place by a button at the top. The person to be executed is bound to the platform and the knife is dropped upon his neck by its own weight, which is sufficient to cause the head to be severed from the body. The Persians and Italians used a similar instrument for beheading criminals, and one called the *maiden* was employed in Scotland in the 16th and 17th centuries. It is commonly supposed that the inventor perished by the machine of his own invention, but this is erroneous, since he founded the academy of medicine after the guillotine was abolished and lived until 1814. The name guillotine is commonly applied to a machine for cutting straw, paper, and other substances.

GUINEA (gĭn'ē), the name of a region in West Africa, bordering on the Gulf of Guinea. As a geographical term it came into use in the 14th century, when the Portuguese explored and traded along the coast, and later the region became the center of a large slave trade. At present it is not used extensively, being displaced by names given to particular localities by European nations, but in a restricted sense it is applied to Angola and Portuguese Guinea. Formerly the region from Sierra Leone to French Congo was known as Upper Guinea and the region south was called Lower Guinea. Annobón, Fernando Po, Principe, and São Thomé were known as the Guinea Islands.

GUINEA, a coin formerly used in Great Britain, so named because it was first made from the gold brought from the coast of Guinea. It came into use in the reign of Charles II., in 1664, and was superseded by the sovereign in 1817. The value of the guinea was 21 shillings, or about $5.06. This coin is rare at present, but it is still customary to use the name for various purposes, especially in estimating professional fees and the price of pictures.

GUINEA, Gulf of, the name applied to a large portion of the Atlantic Ocean, on the west coast of Africa, washing the shore between Cape Lopez and Cape Palmas. The bights of Biafra and Benin are within the gulf. It receives the waters of the Niger and contains the islands of Saint Thomas, Fernando Po, Principe, and São Thomé.

GUINEA FOWL, or **Pintado,** a genus of birds of the turkey family, belonging to the genus *Numida,* native to Western Africa. About a dozen species are included in the group, the best known being the common guinea fowl, which



GUINEA FOWLS.

has been domesticated and is reared extensively. It is about the size of a common fowl, has a quarrelsome disposition, a peculiar harsh cry, and seeks to tyrannize other poultry. The species which are grown most extensively are shy. They have slate-colored plumage with speckled feathers alternating and a naked head, and lay small eggs with a strong shell. The eggs are esteemed for food. Usually the guinea fowl is kept partly as a barnyard ornament and because of its inclination to defend other fowls against their enemies. In the West Indies they are met with in flocks in a wild state, and are seen frequently in numbers ranging from 25 to 50. Some species of Africa and Asia have a pure white plumage. In the time of Roman prosperity the guinea fowl was a favorite bird of the chase and its flesh was highly esteemed.

GUINEA PIG, a class of rodent mammals

GUINEA PIGS.

native to South America. They are a species of cavy and are domesticated and grown extensively as pets. Most of these animals are white, reddish, or white and black spotted. They are very small, about twelve inches long, and resemble the pig only in their grunting voice. Among the common characteristics are short and rounded ears, timid habits, the absence of a tail, and a low degree of intelligence. In South America they occur in large numbers on the banks of the La Plata, in Brazil, Bolivia, and other countries. They most commonly frequent the forests during the daytime in a secluded manner and come out in the evening for food. Their stupidity makes them an easy prey to various serpents and flesh-eating animals, though their loss by destruction in this manner is at least partly overcome by their rapidity in multiplying. They begin to bear young, when only two months old, produce from one to five at a birth, and commonly bring forth from three to six litters each year.

GUISCARD (gēs-kär'), **Robert,** Duke of Apulia and Calabria, sixth son of Tancred de Hauteville, born in Normandy, France, about 1015; died in Cephalonia, July 17, 1085. His eldest brother, William, succeeded in gaining possession of Apulia during the wars of Italy, and at his death Robert was proclaimed Count of Apulia. By skillful management he succeeded in conquering Calabria, his possession of the same being confirmed by Pope Nicholas II. Subsequently he defeated the Saracens in Italy and Sicily and dispatched his son, Bohemond, to undertake the conquest of Corfu, while by his own hasty movement he defeated Alexius Comnenus, Emperor of Greece, at Durazzo in 1081. His next movement was to undertake the capture of Constantinople, but, owing to an invasion of Italy by Henry IV. of Germany, he hastened to repel the invader, and was successful in liberating the Pope from a siege at Saint Angelo in 1084. Subsequently Guiscard defeated the Greeks in Epirus and conquered a number of the islands of the Archipelago, but died suddenly while on his way to Constantinople. Guiscard was a patron of learning as well as a brave and heroic conqueror.

GUISE (gü-ēz'), a ducal family of France, which ranks as a distinguished branch of the house of Lorraine. It was named from the town of Guise in the department of Aisne, France, where it was founded by Claude, son of René II., Duke of Lorraine, who became naturalized in France in 1506. The family continued to exercise influence in the history of France for two centuries. The best known of the Guises is Henry I. of Lorraine, third duke of Guise, born Dec. 31, 1550; assassinated at Blois, Dec. 23, 1588. He became embittered against the Protestants on account of the murder of his father and turned in opposition to them with a spirit of revenge. In 1569 he forced Coligny to discontinue the siege of Poitiers and on Aug. 24, 1572

took part in the massacre of Saint Bartholomew at Paris, where he conducted the assault upon the house of Coligny, who was killed under his personal direction. Afterward he defeated Henry of Navarre, which caused the people to favor him in his ambition to become king, but he was soon after assassinated by agents employed through the influence of Henry III.

GUITAR (gĭ-tär′), a stringed musical instrument which has a hollow body somewhat resembling the violin. It is played by plucking or twitching the string with the right hand, while the left is used to form notes by pressing the strings against the frets on the finger board. It is used principally to accompany the voice in singing. The Moors introduced it into Spain, where it has remained a popular instrument ever since. Those of modern manufacture have six strings. The three lowest strings are made of silk, covered with a fine wire, and the three highest are of gut. At present it is used extensively in all civilized countries.

GUITEAU (gē-tō′), **Charles Jules,** assassin of President Garfield, born in Freeport, Ill., Sept. 8, 1841; executed in Washington, D. C., June 30, 1882. After being admitted to the bar he failed in securing a profitable practice, published circulars of an erratic character on various moral questions, and was divorced from his wife. Later he sought to make his living by lecturing. The Oneida Community of New York expelled him. After the election of President Garfield, he applied for a consular position, and, owing to a failure in securing the appointment, he shot the President on July 2, 1881. When brought to trial, he entered the plea of insanity, but his record and conduct failed to prove him insane.

GUIZOT (gē-zō′), **François Pierre Guillaume,** historian and statesman, born in Nimes, France, Oct. 4, 1787; died Sept. 12, 1874. He descended from a distinguished Huguenot family. After his father was guillotined, in 1794, he was taken to Geneva, Switzerland, by his mother and carefully educated. In 1805 he returned to Paris to pursue a course in law, but soon became interested in literature and art. His first publications to attract attention were his review of Chateaubriand's "Martyrs" in 1809 and a new dictionary of synonyms. In 1812 he published a translation of Gibbon's "Decline and Fall of the Roman Empire," and the same year married Mlle. de Meulan, editor of the *Publiciste System.* His next recognition came in the form of an appointment as professor of history at the University of France.

After the fall of Napoleon, in 1814, Guizot secured several public positions, among them secretary-general of the ministry of the interior, later secretary-general of the minister of justice, and director-general and counselor of state in 1816. With the ascendency of the ultra-royalists in 1820, he was deprived of public office and began to devote his time to writing his "History of France," which appeared in 31 volumes. About the same time he completed his work of 26 volumes, entitled "History of the Revolution in England." In 1829 he again became counselor of state. In the meantime he delivered a series of public lectures which were published under the title, "Course of Modern History," a production which placed him in high repute as a modern historian.

In 1832 he became minister of public instruction, in which position he rendered valuable service in the educational affairs of France by delivering numerous lectures and by publishing courses of study. In 1840 he was appointed ambassador to England. Later he was prime minister of France. The latter position he continued to fill until in 1848, when Louis Philippe fell and he fled to England for safety. Shortly after he returned to Normandy, where he devoted himself to history and literature. Guizot was a Protestant in religion. He was married three times, his first two wives being accomplished literary women. His son, Maurice Guillaume, attained to a literary reputation.

GULF STREAM, one of the most extensive and best known of the oceanic currents, receiving its name from the Gulf of Mexico. All the currents of the ocean are so nearly continuous that they in fact resemble one vast movement. Any given current in the ocean is influenced more or less by the movement of all other oceanic streams. The winds and differences in the density of oceanic waters cause large volumes to pass from near the Equator into the Caribbean Sea, thence through the Yucatan Channel into the Gulf of Mexico, whence it is known as the Gulf Stream, a name applied until it finally disappears as a distinct current, after passing across the Atlantic.

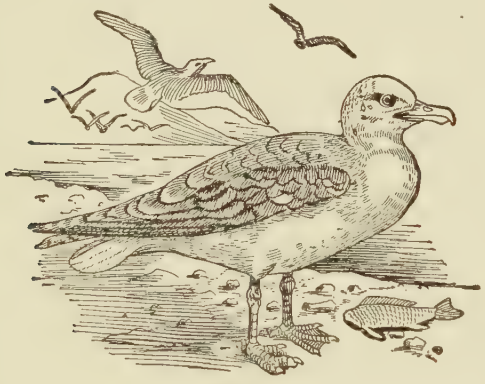
In the Gulf of Mexico it has a temperature of about 50° Fahr., flows as a definite warm current through the Strait of Florida, courses in a northeasterly direction a short distance from the coast of the United States, and has a width varying from 50 to 300 miles. In the Straits of Florida its velocity is about six miles per hour, whence it gradually diminishes, being about four miles per day at its greatest width in the Atlantic. The coast of Europe divides it into two parts, one passing southward along the coast of Spain and to the northeastern part of Africa, and the other flowing to the Arctic Ocean by way of the north coast of Norway. The waters become denser as heat is radiated. On account of this circumstance the stream appears as a middle or lower current farther on in its course.

The effect of the Gulf Stream upon the temperature of the Bermudas is marked, giving these islands a semitropical climate. On the other hand, its union with currents moving toward the northeast along the shores of Europe has a modifying effect upon the climate of Great Britain and the Scandinavian peninsula. How-

ever, when considered by itself, it cannot be said to have a material influence upon the climate of Europe, since it is not sufficiently wide or deep to be highly effective. In commerce it is quite important from the fact that sail-vessels moving in the current are enabled to derive some advantage in navigating portions of the ocean, but in this respect it is of no utility in steamship navigation.

GULF WEED, a genus of seaweeds floating in the Atlantic Ocean within an area of about 250,000 square miles, and so called because they are found chiefly in the Gulf Stream. The best known of the large areas covered by seaweeds is the so-called Sargasso Sea, situated north of the Tropic of Cancer, in the north Atlantic, and west of the Azores. They propagate themselves by breakage. See **Algae.**

GULL, a widely distributed genus of web-footed sea birds. They are distinguished by large wings, small hind toes, slender legs, and a straight bill. Fully sixteen species of gulls have been studied, of which the color is variegated, though the prevailing hues are blackish-slate, pearl-gray, and whitish. Some species



GULL.

have black and white markings on the head that vary at different seasons of the year. The young are brownish and have a dark bill, but at maturity both sexes are very similar in color. They frequent the shores of lakes and the sea, while some species are seen far out from the land and appear to be tireless in their flight. They feed on fish, insects, and various forms of putrid food with much voracity. Their nests are along the shore or in rushes, where they breed once a year and rear from two to four young. The most common species include the *black-headed gull, glaucous gull, common American gull, common herring gull,* and *sea mew.* Sea mews have a cry quite similar to that of a cat, hence the name. The flesh of sea gulls is coarse, though their eggs are prized for table use, and the plumes serve as trimming for ladies' hats.

GUM, a vegetable secretion that exudes from intercellular spaces of certain trees, among them the peach, plum, and cherry. Gums are viscid. The purest varieties are transparent or translucent and pale yellow in color, but sometimes are several shades darker. Among the more valuable gum products are those known as gum arabic, gum Senegal, East India gum, cherry-tree gum, and Barbary gum. The gum taken from the spruce tree is prepared for chewing gum and sold in the market, and there are various other classes of this product prepared and sold in the form of confections. Gum resins are the inspissate juices of certain plants which contain both gum and resins. They are obtained from various plants either by spontaneous exudations or from incisions. They include asafoetida, myrrh, aloes, and many others.

GUM ARABIC (ăr'ā-bĭk), a gum obtained from the *acacia arabica,* a plant abundant in Arabia and India. For the purpose of securing a large yield it is necessary to make incisions in the bark, from which the gum exudes spontaneously. The product is transparent, often colored yellow or brown by impurities. It is inodorous and brittle and has a bland taste. Gum arabic is useful in calico printing, for cement, for ink, in pharmacy, and in finishing fabrics.

GUM RESINS, the dried products obtained from various plants, consisting of a mixture of gum and one or more resins. Alcohol dissolves the resin, leaving an insoluble residue of gum, while the latter is dissolved by rubbing with water. If gum resins are brought in contact with water, the gum dissolves and the insoluble resin forms an emulsion, hence a gum resin requires both water and alcohol to be completely dissolved. The principal products of this class include ammoniac, asafoetida, gamboge, myrrh, and ivy gum resin. These products are solid and opaque, have a strong taste and smell, and are employed chiefly in medicine. Substitute gums are made from the starch of wheat and potatoes by roasting or baking and are used to some extent as substitutes for the more expensive real gums.

GUMTI (gōōm'tē), or **Goomti,** an important river of India, rises in a small lake in the Northwest Provinces, and flows into the Ganges near Benares. The course is generally toward the southeast and is remarkable for its many turns and windings. It is about 485 miles long and it is navigable for small craft to Lucknow, about 300 miles.

GUN, a term applied to any weapon which has a barrel designed to receive and discharge a missile, in the projection of which powder, gun cotton, or air may be employed. The various implements ranging from the hand gun or pistol to the largest cannon are described by the name, but in common use it is customary to limit the term to the sporting gun. When gunpowder first came into use different terms were applied, such as *bombards* in Italy and *crackeys* in England. The early cannons were about the size of large muskets and by means of them it was as com-

mon to throw stone and iron as leaden balls. They were not only comparatively small, but were hard to manipulate, and firing was slow and ineffective as compared with the newer implements of modern times. The most rapid firing in 1638 by the musketeers was from seven to ten shots per hour. At that time it was quite common to use a *match-firing* gun, but soon after the *flintlock* came into general use, this being an invention of highwaymen, who found that firearms in which matches were employed were liable to lead to their discovery.

The flintlock guns were in common use in Europe until 1840, when more effective and rapid-firing weapons took their place. As early as 1540 it was common to use pistols in warfare and for personal protection, the weapons being confined to a place of concealment and used as a surprise to the enemy. The pistols used in the 18th century contained a cylinder with four barrels, which revolved much like the cylinders of newer implements of a like character. At an early date the art of aiming and firing by holding the implement in one hand developed into a very skillful practice, equaled only by pioneers and herdsmen who usually are adepts in the use of the pistol. The modern magazine gun has a shorter barrel and a smaller bore than the old musket, yet the carrying power is greater and its accuracy is of a much higher character. This is due largely to the rifling or grooving of the barrel, an art developed in the last century. The larger implements of war are classed as cannon, which include mortars, howitzers, and siege guns. In the larger cannon the barrels are about sixty feet long. These implements weigh 125 tons, carry projectiles or shells weighing 1,800 pounds, and consume 900 pounds of powder in a single charge. The cannon commonly used in the army and navy weigh about sixty tons, are forty feet in length and five feet in diameter at the larger end, and have a rifle bore. Beside these, mention may be made of the rapid-firing and machine guns, by means of which it is possible to fire as high as 800 shots per minute.

All the different varieties of guns are made of steel. They are thoroughly tested before being used in the public service. The Gatling gun, invented in America and adopted in 1866 for the United States service, was capable of firing 1,200 shots per minute in special tests. The Krag-Jörgensen gun is in extensive use in the infantry of many countries, having been widely adopted in 1896 and since. The largest establishment for manufacturing guns was the celebrated Krupp works at Essen, Germany. This establishment was closed by the terms of the Treaty of Versailles, following the World War. Guns of modern manufacture, such as the trench mortars and the German seige guns, which range up to 16.5 inches and carry 10 to 15 miles, have rendered the old forts useless. Rapidity and accuracy in firing have greatly increased. All the modern guns are breech-loading, the projectile being first inserted, after which the propelling force is placed back of the projectile, and the breech is plugged by means of a substantial screw plate.

GUNBOAT, a vessel of small size, usually supplied with a single gun. Vessels of this class are employed in war for attacking armored vessels, or for defenses on the coast and in rivers. Those of modern construction are armed largely with one heavy gun, which is mounted on the deck. It is commonly set on a pivot in such a manner that it may be turned in any direction. In other gunboats a single gun is so constructed that it may be raised or lowered by means of an engine, and in maneuvering it is necessary to turn the vessel. Iron-plated steam gunboats are a powerful aid in a fleet and are employed extensively as auxiliaries.

GUN CARRIAGE, the vehicle or support upon which a cannon is mounted for service. It may or may not be adapted for transporting the gun. Those used for siege and field purposes have a carriage designed for traveling, which consists of a fore part with two wheels, called a *limber,* and with the carriage proper forms a four-wheeled vehicle. The limber serves for the attachment of horses, but for action it is unlimbered, when it rests on a strong support called the *trail* and its own wheels. Land gun carriages include *casemate, barbette, siege,* and *field carriages.* The first two are intended to be kept in position at a particular fortification, while the last are adapted for transportation as well as for stationary service. The iron carriages of modern construction contain elaborate mechanical parts, combining convenience in transportation and firing, and are sufficiently substantial to endure elaborate use.

GUN COTTON, or **Pyroxylin** (pī-rŏks'ĭ-lĭn), a powerful explosive substance prepared by the action of nitric acid on cotton wool. It was discovered by Christian F. Schönbein (1799-1868), a German chemist, in 1845. His experiments in mixing nitric and sulphuric acids with cotton wool demonstrated that the product possesses a highly combustible property and that its burning results in an explosion. It is prepared at present by drying cotton wool at 100°, then submerging it in a mixture consisting of one volume of nitric acid and three volumes of sulphuric acid, and leaving it immersed for 24 hours. Next it is washed with water or a preparation of alcohol to remove the lower nitrates. It explodes at about 165°, if finally divided, though when compressed it burns like tinder, but may be exploded by a mercuric fulminate. If washed in soda, it retains its explosive properties to the best advantage. The principle advantage of gun cotton over gunpowder is that it can be conveyed safely in a moist state without injury and is almost smokeless. In mining and for torpedoes it serves a highly useful purpose. It has been introduced as an effective agent in warfare. In photography an imperfect

chemical form of gunpowder, known as *collodion,* is used. This is soluble in a compound of alcohol and ether.

GUNNERY (gŭn'nĕr-ў), the branch of science which treats of the construction and mode of firing guns. The term is commonly used in contradistinction to *musketry,* which refers especially to like purposes in small arms. Much has been written on the subject of gunnery, the first standard work being that of Niccolò Tartaglia (1500-1559), an Italian mathematician, who published a treatise called "The New Science" in 1537. Other publications of note are the "Dialogues on Motion" published by Galileo, in 1638, and the "New Principles of Gunnery" by Benjamin Robbins in 1742. The latter writer, besides treating of the resistance of air, bore of guns, methods of taking aim, and force of gunpowder, produced an invention for measuring the velocity of cannon balls, a mechanism not superseded until 1862. By a study of the theory of gunnery it has become possible to solve many problems relative to the best systems of constructing firearms for the purpose of securing the most serviceable motion of projectiles through the air, and for mnufacturing implements of the proper length, rifle bore, thickness, weight, and strength. It has aided in solving the problems involved in actual firing, such as calculating the necessary velocity, range, angle of elevation, rotation of projectiles while passing through the air, and other problems involved both in individual firing and in handling a large number of guns in the time of war.

The guns that are manufactured according to the better methods take into account the necessary velocity of the projectile and the effect upon it by the recoil, as well as the construction most effective in the different kinds of fire, as direct fire, vertical fire, and enfilade fire. By *direct fire* is meant the discharge of projectiles horizontally against the front of a column. In *vertical fire* the gunner aims at a high angle of elevation with the object that the projectile will be caused to fall at a vulnerable point of the enemy. In *enfilade fire* the projectiles sweep against the earthworks or lines of men. Many circumstances must be taken into account in endeavoring to make firing effective. They include the direction and velocity of the wind, the drift due to the rotation of the projectile, the state of the atmosphere as regards heat and moisture, and the movement of the ship and of the enemy. No perfectly satisfactory range finder has yet been discovered, but high classes of guns combined with careful experiments and practice have developed a high degree of proficiency in firing.

GUNPOWDER, an effective explosive mixture of charcoal, saltpeter, and sulphur. The composition varies according to the uses for which it is employed. The ingredients are pulverized separately into fine particles and mixed carefully in the proportion of about 75 per cent. of saltpeter, the remaining 25 per cent. being divided equally between sulphur and charcoal. In manufacturing the mixed materials are subjected to great pressure for the purpose of forming a solid cake, which is then ground into fragments and the grains are separated by sieves. The necessary apparatus includes a series of sieves or screens, by means of which the different sizes are separated from each other. The dust particles remaining are again pressed into cakes, the proper sizes being utilized in forming the different grades of gunpowder, and the coarser residue, if any, is broken into finer particles.

The pressure is applied while the material is in a moist state and determines the character of the explosive, high pressure giving violent action, while the milder pressure causes the product to be less violent as an explosive. When the grains are first separated, they contain sharply marked points, but these are worn off by placing the granulated powder in barrels and revolving them for a period of four to twenty hours. This process is accomplished while the powder is still moist and is necessary to give the grains a perfectly smooth surface. After this process, the granulated powder is glazed with graphite and subjected to a process of drying in a large room under a temperature of 135°.

The most common grades of powder are known as mammoth, cannon, mortar, and musket powder. The last mentioned is the finest grained and is used largely in the smaller firearms. However, coarser-grained powder is more serviceable in the larger guns, since the strain produced by it tends rather to move the projectile forward than to effect an influence by which its force is lost before the projectile is started, as is the case with small-grained powder. In recent years much progress has been made in the use and effectiveness of smokeless powder. This class is used almost exclusively in small and rapid-fire guns by the principal nations, and many of them employ it for field and heavy cannon. The reason that smokeless powder possesses superior value is that the dense volumes of smoke arising from rapid firing tend to obstruct the view and impede the successful operation in time of battle.

The powders usually classed as smokeless are more properly designated as semi-smokeless, since they produce a small amount of smoke. Powders containing ammonium nitrate as a principal ingredient yield products that are largely gaseous and almost invisible. There are three classes of true smokeless powder, of which the ingredients consist mainly of nitrocellulose, a mixture of nitrocellulose and nitroglycerin, and those containing nitro-derivatives of the aromatic hydrocarbons. Among the objects sought in manufacturing an effective and serviceable powder may be named the property of being smokeless. To this must be added high and uniform velocities with safe and regular

pressure, the property of not excessively fouling in the gun, the virtue of not being unusually liable to ignite from the effect of friction or a shock, and that it be not excessively difficult to ignite when placed in the gun ready for use. Besides these essentials, high grade powders must not be impaired by temperature, age, and moisture, and be free from obnoxious and irrespirable gases when used in firing. Manufacturers take into account the chemical and physical effects of powder upon the gun, and seek to produce grades that will not rapidly erode or corrode the barrel.

The history of gunpowder properly dates from the 7th century, when it was employed by the Byzantine emperors to defend Constantinople against the Saracens. However, it is of great antiquity among the Chinese, who employed it for blasting rocks and in manufacturing fireworks long before the Christian era. It is quite certain that the discovery was made by the Chinese while accidentally mixing saltpeter with sulphur and charcoal, and that the products used by them were greatly inferior to the varieties in use at present, or even during the Middle Ages in Europe. A German monk named Berthold Schwartz made valuable discoveries in 1336, which greatly facilitated the manufacture and increased its propulsive power. Guns were used by the British as early as 1327, during the invasion of Scotland by Edward III. In 1342 powder was employed at the siege of Algeciras by the Moors and shortly after attracted the attention of various European nations. The manufactories of gunpowder established in Germany and Italy were among the first in Europe and the first in England were founded about 1590. The American colonists brought gunpowder to America, but even before their time it was used extensively by navigators and explorers who cruised on the American shores. At present the United States ranks as one of the principal powder manufacturing countries in the world, its product being both large in quantity and efficient as an explosive projectile agency.

GUNPOWDER PLOT, a celebrated conspiracy formed in England in 1604 by Robert Catesby and several Roman Catholics of rank for the purpose of blowing up Parliament and the king as a matter of revenge on account of the passage of the penal laws directed against their faith. The time fixed for the execution of the plot was Nov. 5, 1605, and it was designed to destroy the commons, lords, and king by one blow. The plan was to excavate a channel so as to form an underground passage, but later a cellar under the chamber of Parliament was rented and in this the powder was stored. An anonymous letter was sent to Lord Mounteagle, a Catholic peer, advising him not to be present at the meeting of Parliament, which that gentleman delivered to Cecil, then Secretary of State, and from this the plot became known. An investigation led to a discovery of 36 barrels of powder and several large quantities of other explosives, together with billets and faggots. Guy Fawkes was arrested while starting to ignite the explosives, while several others were apprehended, tried at Westminster, and executed on Jan. 30 and 31, 1606. A later investigation demonstrated that the Catholics, with few exceptions, were not implicated and knew nothing of the plot.

GUNSAULUS (gŭn-sa'lŭs), **Frank Wakeley,** clergyman, born in Chesterville, Ohio, Jan. 1, 1856. In 1875 he graduated at Ohio Wesleyan University and was ordained minister in the Methodist Church, but subsequently went over to the Congregational Church. He was pastor in Columbus, Ohio, in 1879-81 and filled several important charges in Massachusetts and Maryland, and in 1887-99 held the pastorate of the Plymouth Church, Chicago. In the latter year he was made pastor of the Central Church, Chicago, and was president of the Armour Institute of Technology in 1873-1906. As a lecturer he is known on account of the subjects "John Hampden" and "Savonarola," having addressed audiences on these topics in all sections of America. His principal publications are "Phidias, and Other Poems," "The Transfiguration of Christ" "Monk and Knight" "Man and His Work" "The Man of Galilee" and "Paths of Power." He died March 17, 1921.

GUNTER (gŭn'tĕr), **Edmund,** mathematician, born in Hertfordshire, England, in 1581; died Dec. 10, 1626. After graduating from Oxford, he became a minister in 1614, and was appointed professor of astronomy in Gresham College, London, in 1619. This post he held until his death. He is noted for several inventions and numerous terms treated by him, such as quadrant, bow, cotangent, and cross-staff, as applied to his inventions. The Gunter's chain in common use for measuring land was invented by him. It is 66 feet long and contains 100 links of 7.92 inches each, an acre being equal to 10 square chains. Gunter's scale is a large plane scale having various lines and numbers engraved on it. This scale serves a useful purpose in making calculations in navigation and surveying by mechanically moving a slide.

GURNARD (gûr'nērd), a family of spiny-rayed fishes, including those called grunters, cuckoos, and sea robins. The common gurnard has an angular head covered with bony plates and the elongated body is tapering and nearly round. It has many sharp spines and peculiar appendages. The flying gurnard has enormous spreading wings and is able to lift itself out of the water with ease. Most species of these fishes utter a peculiar note when above the water, hence the names piper and cuckoo have been applied to them. They frequent the eastern coast of Canada and the United States and are found off the coasts of Europe and Asia. None of the species is more than eighteen inches long and some are regarded good food fishes,

though their uncouth appearance has caused them to be eaten only to a very limited extent.

GUSTAF V., King of Sweden, eldest son of Oscar II., born in the Castle of Drottningholm, June 16, 1858. He studied at the University of Upsala, where he made a creditable record, and entered the military service in 1875. After traveling in Europe, he gave much attention to improvement in military tactics, and was made a lieutenant general in 1892. Later he was inspector of military schools and was promoted to the rank of general in 1898. For seven years, from 1884 until 1891, he was Vice King of Norway. While in this office he was determined to maintain the union between Sweden and Norway, causing him to lose the support of a majority of the radical element among the Norwegians. In 1881 he married Victoria, the granddaughter of William I. of Germany. On the death of his father, in 1907, he became King of Sweden. He assumed the title of Gustaf V., which is the modern form of the name Gustavus.

GUSTAF V. OF SWEDEN.

FLYING GURNARDS.

GUSTAVUS I. (gŭs-tā'vus), known as Gustavus Vasa, King of Sweden, born May 12, 1496; died Sept. 29, 1560. He descended from a nobleman named Eric Johansson and became distinguished in early life on account of his activity in the wars against Denmark. While serving under Svante Sture, he was taken captive and with several Swedish nobles was conveyed to Jutland as a prisoner, but a year later escaped and returned to his native land. After engaging in industrial pursuits, largely on account of the impoverished condition of Sweden, he succeeded in stimulating his countrymen to activity, and in 1520 was successful in expelling the Danes from Stockholm. In 1523 he completed the liberation of Sweden and was elected its king. Soon after he strengthened the army, built canals and highways, constructed fortresses and fostered commercial enterprises. In 1529 the Roman Catholic religion was abolished and Protestantism established in its stead. Later he carried Protestantism to Finland and Lapland, founded schools and colleges, and gave to Sweden a long and prosperous reign.

GUSTAVUS II., known as Gustavus Adolphus, King of Sweden, grandson of Gustavus I., born in Stockholm, Dec. 9, 1594; died at Lützen, near Leipsic, Nov. 16, 1632. He received a liberal education, was brought up strictly in the Lutheran faith, and became able to use efficiently eight different languages. His training included practical work in commercial studies, music, and other useful arts. In 1611 he became King of Sweden and at once entered upon the reorganization of the government, raised a sufficient army to repel incursions by the Danes, and in 1613 concluded a treaty by which important possessions on the Baltic were acquired by Sweden. In 1617 he concluded the Peace of Stolbova, obtaining by it Karelia, Ingria, and a portion of Livonia from the Russians. The following year he traveled extensively in Germany and married the daughter of the elector of Brandenburg two years later. About that time a war began with Poland. After engaging in hostilities nearly nine years, he concluded the peace of 1629, by which important cessions were obtained in East Prussia.

The progress made by Wallenstein in his war against the Protestants caused him to become alarmed, and, his sympathies being aroused by the oppressions of Ferdinand II., he collected an army of about 20,000 and embarked to join the Protestant forces against the Catholic League. In 1630 he landed at the mouth of the Oder and soon came into possession of Pomerania. A short time after, in 1631, he defeated the imperial army at Leipzig, Würzburg, and Bamberg. In 1632 he forced a passage of the Lech and soon after obtained possession of a large portion of Germany. These successes caused Wallenstein to muster an army of 40,000 with which to block the advance of Gustavus,

who purposed to attack Vienna. The two forces met at Lützen, near Leipzig, during a dense fog. Gustavus, while leading a cavalry charge, became separated from his men and was killed by a company of Croats. As a soldier, disciplinarian, and ruler he holds high rank in history, and by his successes became the central hero of the Thirty Years' War. His energetic military campaign in Germany preserved Protestantism to Europe and the world.

GUSTAVUS III., King of Sweden, born in Stockholm, Jan. 24, 1746; died March 29, 1792. He succeeded his father, Adolphus Frederick, in 1771. Soon after he inaugurated a reform policy by forcing the nobles to accept a new constitution, whereby their privileges became much restricted. In 1778 he succeeded in gaining a victory over the army of Russia and Denmark at Frederickshall, and the following year extended his prerogatives by arresting the opposition leaders. Shortly after the commencement of the Revolution in France, he sought to form a coalition with Denmark, Russia, and Spain for the purpose of counteracting republican principles, but was shot by Anckarstroem as a result of a conspiracy formed by the nobles before completing the alliance.

GUSTAVUS IV., King of Sweden, son and successor of Gustavus III., born Nov. 1, 1778; died in Saint Gall in 1837. He succeeded to the throne on March 29, 1792, and pursued the policy of his father in opposing the principles involved in the French Revolution, which caused French troops to occupy Swedish Pomerania and resulted in serious loss of territory to Sweden in 1807. The following year he lost Finland on account of his offending Russia by opening Swedish ports to English vessels. In 1809 a revolution occurred in Sweden, which resulted in the forced abdication of Gustavus on March 29. He was succeeded by his uncle, the Duke of Sudermania, as Charles XIII. Gustavus shortly after left Sweden and died in poverty.

GUTENBERG (gōō'tẹn-bĕrg), **Johannes**, inventor of printing with movable blocks, born in Mentz, Germany, about 1400; died there Feb. 24, 1468. He became known by his mother's name, Gutenberg, his father's name being Johannes Gensfleisch. Little is known of his life aside from his useful invention, which has largely revolutionized civilized arts. He taught stone-cutting, wood-carving, and mirror-polishing in Strassburg in 1434. From a decision rendered in the law courts of Strassburg it is learned that he formed a partnership with Andrew Dritzehn for the purpose of practicing printing with a press and a type mold. He returned to Mentz in 1448, and the following year formed a partnership with Johannes Faust with the view of engaging in the printing business. Faust seems to have been a capitalist and by the terms of partnership furnished the necessary funds to enable Gutenberg to carry on the business. The partnership was terminated in 1455, Faust suing for money advanced and thereby securing possession of the printing supplies and business. In 1455 he concluded a partnership with Conrad Homery, built a new press, and transacted a limited amount of business. The productions of Gutenberg are difficult to identify, owing to a failure to place an imprint on any of them, but it is thought he published several books, both at Strassburg and Mentz. The most important of his productions is the Mazarin Bible, published while in partnership with Faust. His printing was done with wooden type and blocks, but shortly after his death metal type came into general use. The ancient Chinese, Babylonians, and Chaldeans practiced printing from large blocks and several of their pictures and books are extant, but Gutenberg was the first European to introduce the printer's art and reduce it to practical utility. A fine bronze statue, the work of Thorwaldsen, was erected to his memory at Mentz in 1837.

GUTHRIE (gŭth'rĭ), **a city in** Oklahoma, county seat of Logan County, on Cottonwood Creek, 32 miles north of Oklahoma City. It is on the Atchison, Topeka and Santa Fé, the Chicago, Rock Island and Pacific, and other railroads. The surrounding country has large interests in agriculture and dairying. Among the noteworthy buildings are several fine hotels, the Carnegie public library, the city hall, the high school, and the Federal building. Other buildings include the Scottish Rite Temple, a Federal prison, and Saint Joseph's Academy. Among the manufactures are flour, furniture, brooms, machinery, cigars, and cotton products. It has gas and electric lighting, systems of waterworks and sewerage, and Guthrie Business College. Guthrie was founded in 1889, became the capital of Oklahoma Territory the next year, and was the capital of the State from 1907 to 1910. Population, 1907, 11,652; in 1920, 11,757.

GUTHRIE, Thomas, author and orator, born in Brechin, Scotland, July 12, 1803; died Feb. 24, 1873. He studied at the University of Edinburgh and in Paris, and in 1837 became minister of a parish in Edinburgh. In 1843 he went over to the Free Church and for a long time served successfully as minister of Saint John's. In 1862 he was moderator of the general assembly of the Free Church in Scotland. Guthrie possessed remarkable ability as a public speaker, was a devoted advocate of temperance and compulsory education, and displayed a spirit of generosity in founding institutions for the support and instruction of the poor. Among his best known publications are "A Plea for Drunkards," "Sins and Sorrows of the City," "A Plea for Ragged Schools," "The Gospel in Ezekiel," and "Parables and Studies of Character."

GUTTA-PERCHA (gŭt'tà-pĕr'chà), the inspissated juice of the gutta-percha tree, which somewhat resembles caoutchouc, but differs from it in being more soluble and stronger, but less elastic. The gutta-percha tree has a trunk of

two or three feet in diameter, grows to a height of sixty or seventy feet, and abounds in southeastern Asiatic islands, principally in Borneo, Singapore, and Sumatra. The juice is extracted by tapping. It is brownish-red in color when pure, becomes hard and tough below a temperature of 90°, and can be molded into various designs at a temperature of 145° Fahr. Its principal use is for coating submarine telegraph wires as a protection against salt water. In a modified form it is used for the soles of boots, ear trumpets, door handles, bottles, and hose tubes.

GUTZKOW (gŏŏts'kō), **Karl Ferdinand,** novelist and dramatist, born in Berlin, Germany, March 17, 1811; died Dec. 16, 1878. He studied philosophy and theology in the University of Berlin, and subsequently took courses in law and political science at Heidelberg and Munich. His early writings were in the form of contributions to magazines and other periodicals. In 1835 he published his first popular novel under the title "Wally, the Skeptic," but the tone of it was considered destructive of social order and caused him to be imprisoned for three months. He belonged to a class of writers known as Young Germany, who exercised a wide influence toward the social and political contention of 1848. Though his writings were chiefly critical and journalistic, they exercised a profound influence upon the literature and public thought of modern Germany. After 1870 he resided at Berlin, where he continued his literary work until his death. Among his books are "The Magician of Rome," "The King's Lieutenant," "The Knights of the Soul," "Uriel Acosta," "The Philosophy of History," and "The Queue and Sword."

GUYOT (gē-yō'), **Arnold,** famous geographer, born in Switzerland, Sept. 28, 1807; died in Princeton, New Jersey, Feb. 8, 1884. In 1835 he graduated from the University of Berlin, Germany, was associated as instructor with Agassiz at Neuchâtel in 1839-48, and in the latter year accompanied him to America. In 1849 he delivered a course of lectures on "Earth and Man" at Lowell Institute, Boston, and in 1854 became professor of geology and physical geography, which position he filled until his death. In the meantime he delivered several courses of lectures at the Smithsonian Institution. Among his many eminent works are "Treatise on Physical Geography," "Meteorological and Physical Tables," and "Biblical Cosmogony in the Light of Modern Science."

GUZMÁN BLANCO (gŏŏth-män' blän'kō), **Antonio,** South American statesman, born in Caracas, Venezuela, Feb. 29, 1829; died in Paris, France, July 29, 1899. He secured a liberal education at the Caracas University, joined in the Revolution led by Juan Falcon, and in 1863 became vice president of the republic. In 1870 he was elected president and held that office a period of twelve years, during which time peace and prosperity were maintained. He was appointed ambassador to France in 1883 and was again elected president in 1886, but was displaced by a political rival, Rojas Paul, two years later. In 1889 he was deposed by the Venezuelan congress and lived in retirement in Paris until his death. In his administration of the office of president many important canals, railroads, schools, and municipal improvements were made, while the public credit and relations with foreign countries were promoted successfully.

GWALIOR (gwä'lē-ôr), a fortified city of India, capital of the state of Gwalior, about sixty miles south of Agra. Its fortifications are situated on an elevated rocky eminence and are accessible only by steps, the whole constituting the most formidable strategic point in India. The older portion of the city is situated at the base of the rocky heights. It contains a preponderance of stone buildings and is noted for its ancient temples of interesting Hindu architecture. The old town has narrow and illy improved streets, but the newer part, known also as Sashkar, is situated toward the southwest and is well graded and drained. It has systems of pavements and electric street railways. Gwalior has had a long and eventful history and took a leading part in the mutiny of 1857. Population, 1922, 120,208.

GYMNASIUM (jĭm-nā'zĭ-ŭm), a name applied by the Greeks to the public places and buildings where the Grecian youths exercised themselves by running, leaping, wrestling, boxing, and throwing the spear. The most noted of these were located at Athens. That city contained seven resorts classed as gymnasiums, which were frequented not only for gymnastic exercises, but likewise for instruction by rhetoricians, philosophers, and the eminent teachers who delivered their lectures as a means to cultivate the intellectual faculties of youth. The term *gymnasium* is used to designate a system of schools in Germany, which occupy a place immediately between the elementary schools and universities, serving as feeders of the latter. Collectively they are known as *Gymnasia* or *Realgymnasia.* In these institutions the youth of Germany are trained especially for admission to the universities, and before completing the course are required to take a critical examination in at least one modern language, history, Greek, and Latin.

GYMNASTICS (jĭm-năs'tĭks), a word derived from gymnasium and used to designate any system designed to discipline the physical and muscular powers of the body by exercising in feats of bodily skill. Games for the purpose of encouraging outdoor exercises by children are as old as human history, though the various games have been characterized by marked differences in the various ages. Among the most common games to develop physical strength and skill which are popular at present are those of baseball, football, tennis, croquet, rowing, and

others designed especially for children younger than those adapted to playing the recognized standard games. However, the term *gymnastics* is applied more strictly to indoor exercises, usually those that involve muscular activity under system, and are performed in special rooms or departments set aside for the different sexes in many of the schools, colleges, and universities. It has been found that these exercises are helpful in invigorating especially the students of sedentary habits, giving greater strength to muscles and frame, and imparting such a degree of general vigor to the system that intellectual development becomes more marked and rational.

Perhaps the ordinary infantile and childhood pastimes are sufficient to engage the attention of most children until twelve years old, but from that time to the age of thirty-five it is highly beneficial to take rational and suitable exercise at regular intervals, though much care is necessary lest the system be overtaxed and the vital organs fatigued. For this reason it has been found highly profitable to place the gymnasium under special supervision of competent directors and guide the gymnastic training of each pupil in accordance with individual needs. This is true especially in beginners for the reason that some experience is necessary in order to estimate the proper amount of invigorating exercise wholesome to the system.

GYPSIES (jĭp'sĭz), a peculiar race of people found widely distributed in most parts of the world. They are known among themselves as Romani. The name Romani was derived from *Rom,* the Egyptian word meaning man, and *Romni,* meaning woman. Formerly the French called them Bohemians for the reason that they regarded them banished Hussites from Bohemia, while to the Germans they are known as *Zigeuner,* a term thought to have been derived from the Italian *Zingari.* The name Romani seems to imply their descent from the early Egyptians, but the language, which is the same among the wandering companies in all countries, indicates descendance from the people of India, probably from the Hindus. Like the Jews, they have been able to preserve their identity and language in a remarkable degree.

The color of the typical Gypsies is yellowish-brown, the hair and eyes are jet black, the limbs are symmetrical, the teeth are extremely white, and the size is medium. They are rarely content to make permanent settlements, but prefer to wander in emigrant wagons or live in tents. The older women turn a few pennies by telling fortunes, the younger women engage extensively in selling wares and fruits, while the men vend notions, trade horses, perform sleight of hand tricks for exhibition purposes, or engage as general traders. Their musical skill is remarkable and many of their melodies have become incorporated with the most noted operas and cantatas.

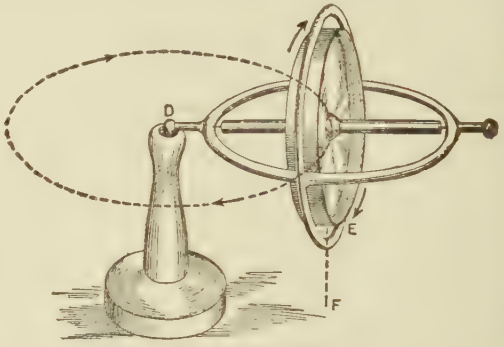
The vocabulary of the Gypsy language is limited to about 5,000 words, which are taught by vocal sounds, and no idea of a general education is possessed. They marry and divorce without much ceremony, have no particular religion, exhibit much delight at turning a good bargain, and are given to amusements and games. As a rule the children are reared in indolence and ignorance, while traits of superstition and boastfulness are common. Historical writers generally agree that they appeared as a wandering people in Germany, Italy, Switzerland, and France about 1417, thence moved into Spain about 1445, into Russia about 1500, and into Sweden and England about 1514. The kings and princes of many countries have been friendly to them on account of their harmless disposition, though in some localities they were charged with being spies and kidnaping children for the purpose of securing ransom. Straggling parties emigrated to America shortly after permanent settlements were made, and at present the Gypsy population in the United States is considerable. The total number of Gypsies in the world is estimated at 650,000, though this does not include those that have became assimilated by other peoples, which, however, does not occur with much frequency.

GYPSUM (jĭp'sŭm), a mineral occurring in monoclinic strata as alabaster in a compact state and as selenite in a crystallized form. It is found extensively in the form of a soft, chalky stone, this being transformed into plaster of Paris by kiln-drying. The common characteristics of gypsum are its color, which includes white, gray, yellow, blue, reddish-brown, and black. It is often transparent, though usually opaque. The grade designated as soft and chalkish stone occurs largely in Michigan, Kansas, Texas, New York, Iowa, Ohio, Canada, Austria, Germany, France, Arabia, and elsewhere. At Paris, France, it is found in extensive masses, hence its name, *plaster of Paris,* when manufactured. The rock masses containing gypsum may be found in any geological age, but occur most frequently in the alluvial formations of the more recent periods. Gypsum is still being formed by the action of water, which holds in solution different ingredients, such as calcareous rock particles carried by mineral waters in volcanic regions, from the combination of sulphuric acid, from iron pyrites, or as a deposit from water in which it is held in a soluble state. It occurs most abundantly in combination with water and is the substance to which the hardness of water is due. Among the uses of gypsum are its employment for fertilizing, cornice moldings, interior decorations for buildings, models in statuary, and in preparing articles for ornamentation, though for most of these purposes it must be subjected to varied forms of treatment. France is the leading producer of gypsum and its products, but it is followed closely by both Canada and the United States.

GYPSY MOTH, an insect native to Europe, where it is highly destructive to the fruit and shade trees. In 1869 specimens were brought to America by Leopold Trouvelot of Massachusetts, who experimented to find some hybrid that would be free from certain diseases of silkworms. Several specimens escaped and the authorities were notified, but efforts to exterminate the insect proved futile, although several million dollars were expended for the purpose. These insects lay their eggs on fences, trees, and other objects in August. The eggs hatch the following spring, when the caterpillars attack the leaves of trees and many plants. In July they become full grown caterpillars, when they form loose cocoons and after two weeks more the moths emerge. The female is white and does not fly, while the male is brown and flies quite rapidly.

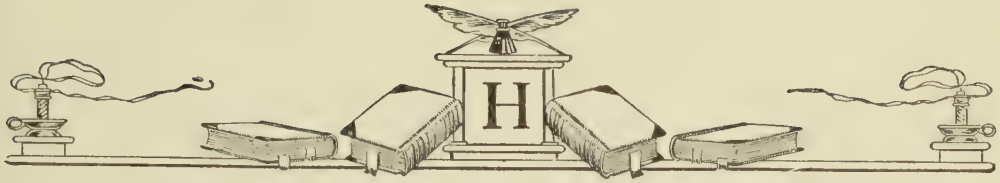
GYROSCOPE (jī'rō-skōp), an instrument used to demonstrate various properties of rotation. It consists of a circular disk so balanced in gimbals that its axis is free to take any direction with the least possible resistance. A reasonably clear idea may be obtained from the *toy gyroscope,* which differs from a top in that both ends of its axis are supported by being mounted in a circular frame. When the disk is put in motion, the entire apparatus not only retains its position as long as the disk revolves rapidly, but it takes up a slow horizontal motion (gyration) in the reverse direction to that in which the upper periphery of the disk is moving. In the illustration, one end of the outer frame, or gimbal, rests on the support D, the arrows indicating the direction of the two movements, which, as long as they continue, prevent the instrument from falling from the position E to the ground at F. This action is due to the principle that a mass set in rotation about its principal axis of inertia continues to revolve about it, the direction of the axis remaining unchanged unless extraneous force is applied.

The gyroscope was invented by Johann Bohnenberger (1765-1831), a German astronomer and mathematician. He first described it in 1817, after employing it in astronomical experiments to show that the apparent rotation of the stars about the earth is due to a real rotation of the earth itself in the opposite direction. In 1862 Jean Foucault, the French physicist, made a similar application. He set a large gyroscope in rotation and, by using a telescope, observed the apparent change in the plane of its rotation due to the movement of the earth. Sir William Thompson devised the *gyrostat,* a modification of the gyroscope, and used it to illustrate the dynamics of rotating rigid bodies. It consists essentially of a fly wheel, the axis of which is fixed within a massive rim, and the rotation is upon fine steel pivots inside a rigid case.



TOY GYROSCOPE.

Although the gyroscope was long considered merely a toy, it has recently been adapted to very practical uses. Otto Schlick of the German navy, in 1904, suggested it as an instrument with which to give ships a steady motion even in very rough water. He devised a gyroscopic apparatus which weighed 1,100 pounds and rotated at a velocity of 1,600 revolutions per minute. The first experiment was with the torpedo boat *Seebär,* which is 115 feet long and has a displacement of 56 tons. The results obtained were entirely satisfactory. Subsequently many passenger vessels have been equipped with the apparatus, the object being to secure greater stability and correspondingly reduce the cases of seasickness. Another notable instance of applying the gyroscope is that of Louis Brennan (b. 1852), an Australian inventor of Irish descent, who is the first to suggest the *monorail railway.* In 1907 he exhibited at London a locomotive which moved rapidly and safely on a single rail, being held in position by two gyroscopes located in an air-tight case. A partial vacuum was maintained in the case and the revolutions were at the rate of 7,500 per minute. Subsequently locomotives and trains of cars have been constructed for experimental purposes, the gryoscopic apparatus being driven by electric power and weighing about five per cent. of the weight of each engine or individual car. In such a train, when it moves rapidly around curves, the gyroscopes lean inward in the manner of a cyclist when rounding a curve.



H, the eighth letter and sixth consonant of the English alphabet. It is usually classed as an aspirate rather than a consonant for the reason that its sound is a mere breathing or aspiration of vocalized breath. Its distinctive sound occurs when it is written as the first letter of a word and when it follows w, as in *help, heavy, hope, where,* and *whither.* In combination with other letters it is used to represent sounds in digraphs, such as *child, this, than,* and *shift,* and in others in which the diagraph is silent, as in *plough* and *bough.* In some cases it is combined with consonants to represent the sound of f, as in *tough* and *enough.* In words taken from the Greek, ch generally has the sound of k, as in *chyle* and *chemistry.* H is used in chemistry as the symbol of *hydrogen.*

HAAKON VII. (hą'kŏn), King of Norway, born in Copenhagen, Denmark, Aug. 3, 1872. He obtained an education under tutors and in public institutions, attended the naval academy, and began service in the Danish navy as midshipman. At the age of 23 years he married his cousin, Maud Alexandria, the second daughter of Edward VII. of England. When Norway and Sweden became formally separated in 1905, he was offered the crown of Norway by the Storthing, which action was approved by popular vote Nov. 12, 1905, and he accepted the position and the title of Haakon VII. He was crowned at the cathedral at Trondhjem in 1906 with the support of all classes of Norway. His son Olaf, the heir apparent, was born in 1903.

HAAKON VII.

HAARLEM (här'lęm), a city in the Netherlands, capital of the province of North Holland, ten miles west of Amsterdam, on the Spaarne River. It is connected by important railroad lines and traversed by a system of canals, and its buildings are largely of the typical style found in the Netherlands. The cathedral of Saint Bavon, one of its finest buildings, is an ancient and famous structure. It was erected in the 15th century, is 425 feet long, and is crowned by a tower 253 feet high. Other buildings include the public library, the townhall, and the meat market, It has numerous scientific schools, associations of general learning, and fine parks and statuary. The manufactures include machinery, beverages, woolen goods, clothing, silk, laces, and embroidery. It ranks high as a center of trade in flowers and merchandise, and is noted as the seat of the most extensive type foundry and printing establishment in Holland. Among the celebrated men born in Haarlem is Lourens Coster, an accredited inventor of movable types for printing. Haarlem dates from the 13th century and obtained municipal rights in 1245. In 1572 it was besieged by Don Frederico, a son of the Duke of Alva, but was finally freed from Spain by the Prince of Orange. Population, 1906, 69,701; in 1922, 70,299.

HABAKKUK (ha-băk'kuk), one of the twelve minor prophets, who flourished in the 7th century B. C., and is noted for his prophecies of God's retributive justice against the Chaldeans. He appears in the light of a prophet of Judah, flourishing from about 630 to 590 B. C. His prophecies hold high rank. They are favorites on account of sublime thought and beauty of construction. Chapter iii., called the prayer of Habakkuk, is a fine lyric ode which contains a prayer and expresses confidence in the promises of God.

HABBERTON (hăb'bĕr-t'n), **John,** author, born in Brooklyn, N. Y., Feb. 24, 1842. He lived in Illinois in 1850-59, where he attended the public schools, and later learned the printing trade in New York. In 1862 he entered the Union army as a private and after the close of the Civil War took up editorial work in New York. He contributed to various periodicals and in 1876 published "Helen's Babies," an amusing account of child life. This work was widely translated and became popular. Other publications include "Other People's Children," "All He Knew,"

"Life of Washington," "The Tiger and the Insect," "The Lucky Lover," "The Scripture Club of Valley Rest," and "The Chautauquans." His drama entitled "Deacon Crankett" has been very popular.

HABEAS CORPUS (hā'bē-ăs kôr'pŭs), a legal writ of relief directed to the person detaining another, and demanding him to produce the body of the prisoner at a specified time and place. The term is of Latin origin, meaning you may have the body. A writ of *habeas corpus* may be issued in all cases where a person in custody claims to be illegally detained or wrongfully refused bail, or who desires to be removed to a different court than the one in which the case is pending. In England, where this writ is called the *writ of right*, it is based upon the Magna Charta, which declares that "no freeman is to be deprived of his life, liberty, and property except by the judgment of his peers and the law of the land." The writ of *habeas corpus* is assured to all persons by the Constitution of the United States and by those of most of the states. It can be withheld only in cases of rebellion or invasion, or when the public safety may require its suspension.

HABIT (hăb'ĭt), the tendency of the body or mind to repeat the same action more or less involuntarily. Habits are acquired through the inclination of the nervous system to repeat its own acts in the same way from time to time. They have a wide range in all our mental and bodily acts, and are likewise concerned in the improvement or debasement of our moral and spiritual nature. It has never been satisfactorily explained why singular facility is acquired by repeated action in accomplishing what at first was either difficult or impossible, but it is generally thought to be due to a condition of nerve force as influenced by the movement of its currents. That is, when a current traverses a nerve tract, it produces a tendency in the nerve center to induce a similar current again under like conditions, and as the currents are reproduced from time to time the nerves become habituated to their passage. Some psychologists find a reason for this power of habit in the sympathetic nerves and others trace it to the association of ideas. However, it is universally recognized that both mental and bodily habits depend upon the repetition of the same act. This gave rise to the useful educational maxim, "Practice makes perfection."

Children and youth need special care to influence the formation of right habits. At that time of life the nervous system is in a plastic condition and may be influenced to act with facility, hence the training should aim to inculcate a tendency toward the formation of wholesome habits with the view of inducing the highest possible physical, intellectual, and moral development. It is important to detect and eradicate bad habits, if such have been acquired, and to replace them with those which tend toward right thought and action. This is important for the reason that right habits economize both time and strength and at the same time tend toward proper and right action. The man for whom education has done all that it can do, who has received the extent of its benefits, finds habit not his master but his most useful servant. Rosenkranz says in this connection: "Education must procure for the pupil the power of being able to free himself from one habit and to adopt another. Through this freedom, he must be able not only to renounce any habit formed, but to form a new one; and he must so govern his system of habits that it shall exhibit a constant progress of development into greater freedom. We must discipline ourselves, as a means toward the ever-changing realization of the good in us, constantly to form and to break habits."

HACK, or **Hackney Coach**, a coach or carriage which is let out for hire. It is usually a vehicle with two seats inside facing each other. The term is commonly applied to a cab.

HACKBERRY (hăk'bĕr-rў), a tree of the nettle family, sometimes called sugar berry, nettle tree, and hoop ash. The common hackberry of North America ranges from Canada to Tennessee, extending westward to the Pacific. It is about three feet in diameter and from 80 to 120 feet high, and has rough bark and nearly horizontal branches. The wood is coarse-grained and heavy and in value may be classed with that of the elm. Other species are found in different parts of Canada and the United States, including the species usually known as *sugar berry*. The lotus tree of Europe and Asia is a species of the hackberry. It attains a height of about 70 feet, and the wood is used in carving and for making furniture.

HACKENSACK (hăk'ẹn-săk), the county seat of Bergen County, New Jersey, on the Hackensack River, eight miles southeast of Paterson. It is on the New Jersey and New York and other railroads and has communication by several electric lines. Among the conveniences are city lighting, pavements, a public library, and several fine school and church buildings. It has manufactures of brick, silk, jewelry, and utensils. Many business men of New York City have their residences at Hackensack. The place was settled about 1640 by the Dutch. Washington, while retreating through New Jersey, stopped here in 1776, but it was afterward occupied by the British. Population, 1920, 17,667.

HACKETT (hăk'ĕt), **James Keteltas**, actor, born at Wolf Island, Ontario, Sept. 6, 1869. His father, James Henry Hackett (1800-1871), was noted as an American comedian. The son was educated at the College of the City of New York, where he graduated in 1891, and the following year made his début at the New York Lyceum. He rose to the position of the leading player at the Lyceum in 1896 and subsequently toured many of the cities of Europe and America. In 1897 he married Mary Mannering, an

actress, and played successfully with her in "The Walls of Jericho" and a number of other popular plays. He made his greatest successes in "The Pride of Jennico," "The Prisoner of Zenda," "Rupert of Hentzau," and Winston Churchill's "The Crisis."

HADDOCK (hăd'dŭk), a fish belonging to the same family as the whiting, coalfish, and cod. In size it is smaller than the cod, but it resembles that fish. It has three dorsal fins and a pale-brown back, but the under part is silvery-white. The forehead is flattened between the eyes. This species of fish is valued for food, weighs from two to eight pounds, and breeds in the northern seas in February and March. The haddock is a common fish on the Atlantic coast of North America and Europe. An allied species called the *Norway haddock* is smaller and is abundant off the coast of Newfoundland. The salted and smoked flesh of the haddock, known as *finnan haddie,* was first prepared by the Scotch, whence the name.

HADES (hā'dēz). See **Hell.**

HADJ. See **Hajj.**

HADLEY (hăd'lĭ), **Arthur Twining,** educator, born in New Haven, Conn., April 23, 1856. His father, Prof. James Hadley, gave him the advantage of a careful elementary education and a thorough course at Yale University, where he graduated in 1876. Subsequently he pursued advanced studies in the University of Berlin. He was tutor in Yale University from 1879 until 1883 and subsequently engaged in journalistic work. In 1885 he became commissioner of labor statistics for Connecticut, was chosen professor of political science at Yale University the following year, and in 1899 was made its president. His "Railroad Transportation, Its History and Its Laws," was translated into Russian and French, and on account of it he made an expert witness before the committee that drafted the Interstate Commerce Law. He was associate editor of "Johnson's Universal Cyclopaedia," having charge of the department of political economy, finance, and transportation, and contributed many essays to popular periodicals. His publications include "Report on the System of Weekly Payments," "Report on the Labor Question," and "The Education of the American Citizen."

HADLEY, James, philologist, born in Fairfield, N. Y., March 30, 1821; died Nov. 14, 1872. He graduated from Yale College in 1842, taught there until his death, and is celebrated on account of his proficiency in Greek, Sanskrit, Hebrew, Arabic, Irish, and many other languages. Among his writings are "Elements of the Greek Language" and "The History of the English Language." His "Lectures on Roman Law" was published posthumously.

HADRIAN (hā'drĭ-ăn), **Arch of,** a triumphal arch at Athens, southeast of the Acropolis, erected by Hadrian or his successors. It is in a good state of preservation. The structure is 44 feet wide and 59 high. It was erected to divide Hadrianopolis from the ancient city of Theseus. Another structure erected by Hadrian is his tomb in Rome, which is now known as the Castel Sant' Angelo. It was completed under the direction of the emperor about 135 A. D. and was surrounded by beautiful gardens which extended to the Tiber. Though in a good state of preservation, the *Tomb of Hadrian* is partly concealed by works of fortifications that were erected in comparatively recent times. The *Villa of Hadrian* was located near Tivoli, about fifteen miles from Rome, and had an area of several square miles. It contained fine baths, theaters, terraces, libraries, and gardens, and the decorations were largely those obtained from Greece or made specially in imitation of Greek masters. The most important treasures now extant are in the museums of Rome, but many ruins are still found where the villa was located.

HADRIAN, Publius Aelius Hadrianus, Emperor of Rome from 117 to 138 A. D., born in Rome, Jan. 24, 76 A. D.; died in Baiae, July 10, 138. His father was a cousin of Emperor Trajan and died when Hadrian was but ten years old, and the latter was brought up under the charge of his kinsman. His connection with Trajan secured for him appointments to several important offices and distinction in the army, especially for the service rendered in the two Dacian campaigns. When Trajan returned to Italy, in 117, he was left in Asia as prefect of Syria. Having made himself popular with the army, he was declared emperor at the death of Trajan in the same year.

Hadrian immediately entered upon plans to pacify the internal differences in his vast dominion. Insurrections were in progress in Syria, Palestine, and Egypt, while the Parthians and others were seeking to attain independence. Adopting a policy of conciliation, he secured peace with the Parthians by ceding all possessions east of the Euphrates, concluded peace with the Roxolani by making monetary payments, and grew in popular favor at Rome by encouraging education, furthering internal improvements, and lightening taxation. About 120 he entered upon a tour of visitation to the different provinces of the empire for the purpose of studying their needs. After touring through Germany, Gaul, and Britain, he visited Spain, passed eastward into Asia Minor, and traveled through Northern Africa. Upon reaching Greece, he settled for three years at Athens, but returned to Rome about 127. In 133 his army subdued a rebellion of the Jews after a destructive war of several years, this being the only armed conflict of considerable extent to disturb the peace of his long and successful reign. The "Edictum Perpetuum," a general code of laws, was promulgated by him in 131. The laws of Rome were based on the code of Hadrian for many years.

HAECKEL (hĕk'ĕl), **Ernst Heinrich,** famous evolutionist, born in Potsdam, Germany, Feb. 16, 1834. He studied at Würzburg, Berlin, and Vienna. His intense interest in zoölogical studies soon attracted the attention of scholars and led to his appointment as teacher at Naples and Messina. In 1861 he became private tutor in the University at Jena and was made professor of zoölogy there in 1865. Haeckel formed an intimate friendship with Darwin, traveled extensively in Eurasia and Africa, and visited many islands for the purpose of making original investigations of coral reefs and other forms of marine life. He is undoubtedly one of the most eminent evolutionists of the 20th century, and has attained to renown by his indefatigable research and careful study of that theory. Among his achievements are several new discoveries by which he fortified the doctrine that each organism repeats its phylogenetic history as it develops into maturity. He is the author of numerous publications, including "The Origin and Development of Animal Tissues," "Life in the Sea-Depths," "Deep-Sea Medusae," "Darwin, Goethe, and Lamarck," "Radiolariae," "The Natural History of Creation," "The Riddle of the Universe," and "A Visit to Ceylon." He died Aug. 9, 1919.

ERNST H. HAECKEL.

HAFIZ (hä'fĭz), **Shams-ud-Din Muhammad,** Persian philosopher and grammarian, best known by his poetical name Hafiz, born in Shiraz in the early part of the 14th century; died about 1390. The attention of the reigning family of Persia was attracted by his studious habits and thorough scholarship, which caused him to be appointed as teacher to the royal family, and a government college was established in his honor. Soon after entering upon his work under royal direction, he produced many noteworthy poems relating to flowers, birds, sentimental subjects, and habits of life, and it is chiefly on account of his poetic productions that his name is well known in every family of Persia. The clear style and wonderful imagery of his writings have caused them to be translated into modern languages, and their popularity is still extensive in many countries of Eurasia and Africa. His collected work, called "Divan," contains seven elegies and 570 odes, called *gazels.*

HAGEN (hä'gĕn), a city of Germany, in the Prussian province of Westphalia, 42 miles from Cologne. It is located on the Volme River and several railroads and is surrounded by a productive agricultural country. The manufactures include cotton goods, tobacco, iron and copper products, and machinery. It has electric lights and railways, stone and asphalt pavements, and a large trade in produce and merchandise. It is the seat of several technical schools. Population, 1905, 77,567; in 1920, 88,625.

HAGENBECK (hä'gĕn-bĕk), **Karl,** animal trainer and circus manager, born in Hamburg, Germany, in 1844. His father established a trade in animals at Hamburg, in 1852, and the business passed to the son in 1875, after which it was greatly enlarged. He sent expeditions to Africa and other continents annually to obtain wild animals and later traveled through Europe with exhibitions of animals and various races of people, including a number representing life in Oceanica, Africa, and the Arctic regions. In 1886 he traveled with a circus in Canada and the United States, and at the Columbian Exposition of 1893 exhibited about a thousand wild animals. He made a similar exhibit during the summer of 1904 at the Louisiana Purchase Exposition in Saint Louis, where he exhibited rare specimens of wild and trained lions, bears, leopards, tigers, elephants, and sea lions. Subsequently he made extensive and successful tours through Europe and America. He died April 14, 1913.

HAGERSTOWN (hā'gĕrz-toun), a city in Maryland, county seat of Washington County, in the Cumberland valley, 86 miles northwest of Baltimore. It is on the Baltimore and Ohio, the Norfolk and Western, and other railroads. The chief buildings include the county courthouse, the Y. M. C. A., the armory, the Washington County Library, and several schools and churches. The city is noted for its social refinement, beautiful streets, and electric and steam railway facilities. Among the manufactures are furniture, farming implements, cigars, fertilizing, flour, pottery, brooms, and machinery. The surrounding country is agricultural and fruit growing. Hagerstown was settled about 1740 and is governed under a charter issued in 1885. Population, 1920, 28,020.

HAGFISH (hăg'fĭsh), or **Hag,** the name of a class of fishes structurally related to the lamphrey. They live as parasites upon other fishes. The shape of the body resembles that of an eel, but they have no visible eyes and the mouth is round and formed for suction. Eight tentacles or barbels surround the mouth, which has a single tooth in the upper part, and two rows of strong teeth are attached to the tongue. The body is slimy and has no scales or bones, but is membranous and cartilaginous. They attach themselves to fishes and bore their way to the inside by means of the mouth, and in the course of time consume the body, leaving only the skeleton and entrails. The common hagfish is about fifteen inches long. It is very abundant off the west coast of North America and on the east coast from Cape Cod north, where it is known as the *slime eel.*

HAGGAI (hăg'gā-ī), one of the minor prophets, whose name in Hebrew means "born on a festival." He was the first to prophesy after the captivity. The date of his book is fixed in the second year of the reign of Darius I. (Hystaspis), in 520 B. C. His productions relate largely to the rebuilding of the temple, and were designed to enthuse his countrymen in devotion to their privileges and the worship of God. In his predictions are foreshadowed the building of a kingdom and the restoration of Jewish prosperity.

HAGGARD (hăg'gĕrd), **Henry Rider,** novelist, born in Norfolk, England, June 22, 1856. After attending the Ipswich grammar school, he went to Natal, in 1875, as private secretary to Sir Henry Bulwer. In 1879 he returned to England, retired from official life, and engaged exclusively in the study and work of producing contributions to literature. Although his works have been widely read, they cannot be classed as having an enduring style or material artistic value. Among his best known writings are "King Solomon's Mines," "Dawn," "She," "Joan Haste," "Cleopatra," "Elissa, a Zulu Idyll," "Swallow, A Story of the Great Trek," and "The Heart of the World." He died May 14, 1925.

HENRY RIDER HAGGARD.

HAGUE (hāg), **The,** a city in the province of South Holland, capital of the Netherlands, fifteen miles northwest of Rotterdam. It is pleasantly situated three miles from the North Sea, 23 miles southwest of Amsterdam, and is connected in all directions by canals and railroads. It has communication by steamship lines with the leading ports of Europe. Among the noteworthy buildings are the palaces of the general government, several historic churches, a system of public schools, a number of colleges, and a university. The royal library contains 525,000 volumes, besides which are other public institutions, such as a public museum of antiquities and modern art, several parks and zoölogical gardens, an electric street railway system, and stone and asphalt pavements. The Hague is the most fashionable and modern city in Holland, and about three miles from it is the celebrated Scheveningen, a favorite bathing and pleasure resort on the coast. The royal villa of Huis ten Bosch, located in a forest near the city, has costly decorations and valuable collections of art.

The Hague does not rank high in commerce, but it is the seat of many industries. Among the manufactures are firearms, jewelry, furniture, musical instruments, clothing, hats, machinery, and textile fabrics. Owing to its excellent facilities for entertaining visitors, it has been a favorite place for holding international congresses. Among the most recent held here is the peace conference suggested by the Czar of Russia in 1899. This conference was called for the purpose of considering the gradual disarmament of civilized nations, whereby, if consummated, the burdens of vast standing armies would be lessened greatly.

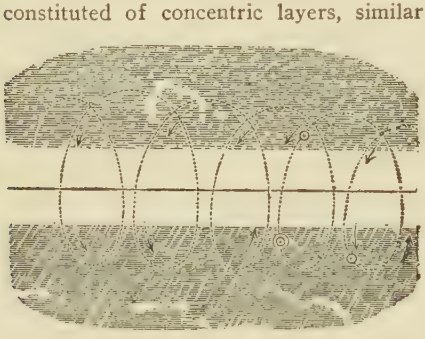
The Hague was made a princely residence under William II. in 1250. In the 16th century it became the seat of the stadtholder of Holland and from the 17th to the 18th centuries it was the diplomatic capital of Europe. The Treaty of Ryswich, concluded in 1697, was signed at the castle of Ryswich. About three-fourths of the inhabitants are Protestants. Population, 1906, 248,995; in 1922, 366,405.

HAHNEMANN (hä'nę-män), **Samuel Christian Friedrich,** founder of the homoeopathic school of medicine, born in Meissen, Germany, April 10, 1755; died in Paris, July 2, 1843. He studied in his native town, and afterward at the universities of Leipzig, Vienna, and Erlangen, graduating from the last named in 1779. Soon after he began the practice of medicine, in the meantime translating numerous works into German from the French, Latin, and English. In 1789 he returned to Leipzig for the purpose of continuing research in advanced chemistry. While there he translated Cullen's "Materia Medica" into the German and became impressed with the unsatisfactory explanation given in that work for the effect of Peruvian bark in the treatment of ague. To learn of the effect of this medicine upon the human system he took several large doses and experienced ague symptoms, and from this he deduced the theory that a medicine having the properties to cure a disease possesses the ingredients necessary to produce symptoms of that disease in good health. In a like manner he found that healing is effected rather by small than large and violent doses, from which he deduced another important theory; namely, the one having reference to a consideration of proper quantities of medicine in the healing art. Subsequently he devoted his attention to the publication of his theories. The most important of his writings include "Essays on Poisoning by Arsenic," "Dictionary of Materia Medica," and "Effects of Coffee."

HAIG, Sir Douglas, British commander, born June 19, 1861; died at London, England, Jan. 30, 1928. He studied at Oxford, served in the Sudan in 1898, and commanded in the South African War and in India. In 1914 he was raised to the rank of general and in 1917 was made field marshal, owing to distinguished service in France.

HAIL, the small masses of frozen rain or congealed vapor falling from the clouds in showers or storms, constituting pellets or hailstones of variable size and shapes. Hail results when considerable differences of temperature exist between the lower and higher strata of air, and the presence of intense cold causes the moisture to condense suddenly. Usually there are several layers of dark, grayish clouds which move in different directions and have a varying temperature. Two kinds of hail are generally recognized, one consisting of small grains, which usually precedes the fall of snow, and the other being composed of hailstones. The latter class occurs most commonly in the spring and summer, but reaches its greatest severity and frequency in tropical climates. It is probable that the small hail pellets are formed by raindrops freezing as they fall through strata of colder air than those in which they were formed as raindrops. The larger class of hailstones are thought to be due to the coming together of clouds of vastly different temperatures.

On examining a large hailstone it is found to be constituted of concentric layers, similar to



THEORY OF HAIL BY ROTARY MOVEMENT.

those of an onion, arranged around a central nucleus formed generally of snow, but sometimes of ice. The stones are more or less spheroidal in shape and weigh from a few grains to several ounces, though hailstones weighing several pounds sometimes occur. The theory that accounts for the layers is that there are currents of wind which rotate like cyclones, but instead of having vertical axes, the movements are horizontal. In such cases several horizontal and almost parallel strata of clouds form some distance apart, the upper layer of snow and the lower of rain. The nuclei of the hailstones are formed in the upper layer in the form of snowflakes, are caught in the rotating currents of wind and carried alternately through the two layers of clouds, and in this way receive successive coatings of snow and ice until they finally fall to the ground.

Some naturalists attribute the influence of electrical attraction and repulsion as formative agencies of hail, since thunder and lightning invariably attend hailstorms. Other writers hold the view that there are many alternate layers of different clouds during the formation of large hailstones, and, in falling from the upper stratum through the different lower strata, they take on the peculiar characteristics by whirling through the successive cloud formations. Hailstones measuring about one-fourth of an inch in diameter are most frequent, but stones having a diameter of from two to five inches sometimes occur. In hot climates they are frequently of the larger size and effect much damage to growing crops. Noteworthy hailstorms are those which occurred in New Hampshire in 1851, at the Cape of Good Hope in 1860, and in Moravia in 1889. At the time of these historic hailstorms stones weighing from eighteen ounces to four pounds fell to the ground, destroying much vegetation and some human life. In many localities hailstorms occur in which the bark of trees is punctured, the heaviest plate-glass windows are broken, and the shingles of houses are destroyed.

HAILMANN (hāl'mān), **William Nicholas,** educator, born in the canton of Glarus, Switzerland, Oct. 20, 1836. He was educated under a private tutor and at the Gymnasium of Zurich, and in 1855 studied at the medical college in Louisville, Ky., where he afterward taught in the public schools. In 1865-73 he was director of the German and English Academy in Louisville and subsequently held similar positions in Milwaukee and Detroit. He was superintendent of the public schools at Lakeport, Ind., from 1883 until 1894, and in the latter year was made the national superintendent of Indian schools. His publication entitled "History of Pedagogy" has been used very extensively in normal schools and institutes. Other works of which he is author include "Outlines of a System of Object Teaching," "Primary Methods," "Kindergarten Culture," "Application of Psychology to Teaching," and "Place and Development of Purpose in Education." He translated Frobel's "Education of Man" and edited *The Kindergarten Messenger and New Education.*

HAINAN (hī-nän'), an island in the China Sea, east of the Gulf of Tonquin, belonging to the province of Kwangtung, China. It is separated from the mainland by the Strait of Hainan. The area is 13,600 square miles. It is well wooded and has fine groves of palm and cocoanut trees. Cotton, tobacco, rice, sugar cane, and fruits are grown profitably. A large majority of the inhabitants are Chinese. Kiang-chow, an important seaport on the northern coast, is the capital. Population, 1922, 2,450,850.

HAIR, one of the threadlike structures that grow from the skin or outer covering of mammals, serving as a protection similarly to the feathers and down of birds and the scales of fishes and reptiles. All species of mammals in an adult state have hairs, which vary greatly in structure, as is noticed by comparing the finer kind of wool with the *bristles* of the hog and the *quills* of the porcupine. The hairs of the

human head furnish a protection in heat and cold and serve as a shield against blows. All parts of the body, except the palms of the hands and the soles of the feet, contain more or less hair growths, and the parts usually described as destitute of hairs are covered with a small colorless growth. In some males the breast, arms, shoulders and other portions have hairs much like those common to the head.

Each hair is hard and compact on the outside, and contains layers of colorless scales overlying one another like the shingles of a roof. The interior is porous and is thought to contain the liquids by which it is nourished. It is a modified form of the epidermis, growing from a tiny bulb called the *papilla,* which is an elevation of the cutis at the bottom of a little hollow in the skin. The hair is produced from the surface of the bulb, like the cuticle, by the constant formation of new cells at the bottom, the old cells being pushed forward to constitute a portion of the hair shaft. Minute pigment granules, which are contained in the cells of the hair, determine its color.

Race characteristics greatly influence the color of the hairs, but it is likewise modified by age, sex, climatic conditions, and various other circumstances. In infancy the color is light and with age it becomes darker and less fine. A growth of hairs commences in the armpits and on the breast at the age of puberty in both sexes and in males a beard begins to appear. If the hair bulb is destroyed, the hair never grows again, but, if uninjured when a hair is pulled out, a new one is produced. Baldness is due usually to an affection of the papillae, which results generally from an impairment of the blood circulation in the scalp, and grayness is attributed to the same cause, or to a deficiency in the amount of pigment granules in the hair cells. The hairs themselves are destitute of feeling, but nerves are located in the hollow in which each hair is rooted, thus accounting for the pain experienced when a hair is pulled. Small glands are connected with the hairs, which serve as lubricators to them and the skin by secreting an oily substance.

The tendency of hairs to stand erect under the influence of cold or electricity is due to muscles interlacing among the fibers of the skin. In some animals these muscles are so well developed that the hairs may be moved to drive away flies, as is the case in horses, cattle, and sheep. Next to the bones and teeth, the hairs are the most indestructible portions of the body and the color is preserved for many years after death. The hair structure in plants is an outgrowth of the epidermis and may be either a single cell, a cell row, a cell surface, or a cell mass. These hairs usually consist of minute transparent tissues more or less elongated, arranged in a single row, and are of various types, such as scabrous, stellate, and uncinated hairs.

Hairs constitute an important material for manufacturing, but those taken from horses, cattle, goats, sheep, hogs, camels, and alpacas are the most valuable. The purposes to which hairs are best adapted include the manufacture of upholstered furniture, haircloth, brushes, and fishing lines. They are employed in plastering, spinning, and weaving various kinds of textile fabrics. Human hairs are used extensively in the manufacture of beards, wigs, watch chains, and other articles of dress and ornament. In Italy, Germany, France, and other European countries peasant girls sell their hair to dealers for the purpose of manufacture, these products being best when taken from living subjects. Other purposes to which hairs are put include the manufacture of brushes and hair pencils for painters, dusting brushes, and numerous fancy articles.

HAIR DRESSING, the art of taking care of the hair. It has been a subject of much study from remote antiquity, especially by the fashion

HAIR DRESSING.

Egyptian Roman 15th Century 16th Century 17th Century 18th Century

mongers and the people engaged in hair dressing. In the costume of some classes it forms an important agent to convey an idea of personal dignity or rank in the community, but more frequently it is entirely decorative to the person. The ancient Egyptians were extremely careful in taking care of the hair, as may be seen from their paintings and bas-reliefs, which show that the hair was carefully curled or plaited. False hair and beards were worn in many parts of Western Asia, where the Hebrews and others considered a bald head very

unbecoming. The custom was taken to Greece and Rome, where the hair was worn short by artisans and warriors, but many of rank prided themselves on having a fine growth of long hair.

The practice of elaborate hair dressing reached its height in the 15th and 16th centuries. At that time the men had their beards tightly curled and gummed, while the women took pride in wearing the hair on cushions or supports, giving the appearance that the growth of hair was very prolific. In the 18th century, during the reign of Louis XVI. of France, the women wore the hair in a fantastic style. It was combed upward and stiffened with wire, hence gave the appearance of being about twice as large as the head, and at the upper part were decorations of beads, ribbons, and feathers. The practice of wearing wigs continued during this period and is still fashionable, but the forms are much smaller than those of former times.

The *chignon,* or waterfall, worn formerly is not fashionable at present. It is now fashionable for women to have their hair cut, either in styles known as *bobbed* or *shingle-bobbed,* and to have them treated to produce a wave-effect. Men almost universally wear their hair cut short and the majority shave the face smooth or wear a small moustache. As a whole there has been a tendency toward simplicity in hair dressing, with the design that it serves for ornamentation to suit the individual. *Hair dyes* are used to a considerable extent to conceal approaching age or retain the natural color of youth. Substances used for this purpose include preparations made of sulphur, bismuth, and various vegetable juices, such as the juice of oak bark and of green walnut shells.

HAIRLESS DOG, a kind of dog whose skin is almost entirely naked, or whose body has a few hairs scattered in different parts. The hairless dog of Mexico is the best known American species and is frequently seen at the exhibits of pet dogs. It somewhat resembles the black-and-tan terrier, but is less active and lacks the keen eye, and the skin in most specimens is wrinkled. The African hairless dog resembles the greyhound in form and is entirely naked, except that it has a few tufts of hair on the legs, around the mouth, and near the tail. A naked dog of China, known as the Oriental hairless, is formed like the small greyhound terrier and is cooked and eaten by the Chinese as a delicacy. The hairless dog of the Philippine Islands is another well-known species. It is popular as a pet among the natives, especially the Tagals.

HAITI. See **Hayti.**

HAJJ (hăj), or **Hadj,** the pilgrimage to the Kaaba at Mecca, performed by the Mohammedans. One who makes the pilgrimage becomes known as a *hadji,* which Orientals regard a respectable salutation or a title of honor. The pilgrimage dates from the time of Mohammed, who grew more fond of the Kaaba as his years increased, and he visited it for the last time the year before his death. The institution of the pilgrimage as one of the five cardinal duties of every Mohammedan dates from that time. While the visit may be made any time, the full rites of the Hajj, which includes a visit to Mount Arafat, is carried out only in the twelfth month of the Mohammedan calendar, called *Dhul Hajjeh.* Some of the pilgrims begin the journey one or two months before the appointed time of the meeting, depending upon the distance to be traveled. The number of pilgrims varies greatly, but a concourse of 100,000 is not uncommon. Many travelers have made the pilgrimage in disguise, including T. F. Keane, in 1878, who published an account of the journey.

HAKLUYT (hăk'lo͞ot), **Richard,** historian and geographer, born in London, England, in 1552; died there Nov. 23, 1616. He studied at Oxford, where he was professor of divinity a number of years, and in 1584 accompanied the English ambassador to Paris. While in France he found an account of a voyage to Florida, which he edited and published, and subsequently produced a large number of works upon history and geography. In 1603 he became archdeacon at Westminster. In the meantime he translated Fernando de Soto's "Virginia Richly Valued." His accounts of voyages to America greatly stimulated interest and colonization in the New World.

HAKODADI (hä-kō-dä'dē), or **Hakodate,** a seaport city of Japan, near the southern extremity of the Island of Yezo. It is located on a bay extending inland from Tsugaru Strait, has an extensive harbor, and is strongly fortified. The architecture is singularly Japanese, including a naval school and a commodious townhall. Transportation is facilitated by tramways. It has electric lighting, waterworks, and well-paved streets. The city is a treaty port, hence has a large foreign trade. It is the seat of several mission schools and consulates. The port was opened for commerce in 1859. Population, 1922, 85,313.

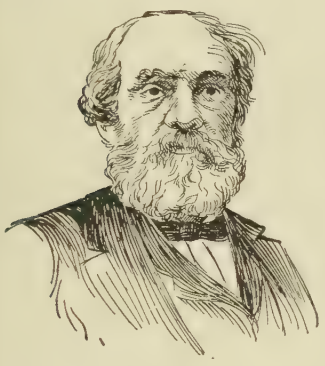
HALBARD (hŏl'bĕrd), or **Halberd,** a weapon employed in warfare during the Middle Ages. It consists of an ax blade balanced by a pick, having an elongated pike head at the end of a staff from five to six feet in length. The earliest halbards were used in the 14th century. The English *halbardiers* were troops who performed special duties, such as defending the colors, and reached their height of efficiency in the 16th century.

HALBERSTADT (häl-bĕr-stät'), a city of Germany, in Saxony, 28 miles southwest of Madgeburg. It is located on the Holzemme River and several railways, and has considerable trade in merchandise and manufactures. The chief buildings include the Cathedral of Saint Stephen, the Church of Our Lady, the market, and a number of schools. Among the manufac-

tures are leather, sugar, cigars, soap, gloves, and machinery. The city became a part of Brandenburg in 1648. Population, 1922, 45,529.

HALCYON (hăl'sĭ-ŏn), the poetical name applied to the kingfisher from early historic times. According to Greek mythology, Halcyone and her husband, King Ceyx, were transformed into kingfishers, hence the name halcyon. The idea of the ancients was that these birds lay their eggs in nests floating on the surface of the sea in calm weather, before and after the shortest day of the year, when the gods were supposed to keep the water smooth and tranquil for their benefit. Hence, the term *halcyon days* signifies a period of rest and untroubled felicity. This Grecian legend is mentioned by Shakespeare, Socrates, Aristotle, and other writers.

HALE, Edward Everett, clergyman and author, born in Boston, Mass., April 3, 1822. In 1839 he graduated from Harvard, was ordained a minister of the Congregational Church in 1842, and in 1846 became pastor at Worcester, where he remained until 1856, when he was selected as pastor of the South Congregational Church in Boston. A doctorate in theology was conferred upon him by Harvard in 1879. As a minister, lecturer, and writer he was indefatigable and exercised a wide influence for the elevation of mankind. His first editorial work was on the *Daily Advertiser,* published in Boston. Later he revived the *New England Magazine* and in 1869 founded the *Old and New,* which was later merged into *Scribner's Monthly.* In 1870 he published "Ten Times One is Ten," a book which led to the organization of a system of clubs known as Lend a Hand, Lookup Legion, and Harry Wadsworth clubs. The motto of these clubs was, "Look up and not down; look forward and not back; look out and not in; and lend a hand." Among his best known publications are "In His Name," "My Double and How He Undid Me," "A Man Without a Country," "Through Mexico," "Story of Massachusetts," "Family Flight Over Egypt and Syria," "Life of George Washington," "History of the United States," "Memoirs of a Hundred Years," and "Prayers in the United States Senate." He edited an American edition of Lingard's "History of England." He died June 10, 1909.



EDWARD EVERETT HALE.

HALE, Eugene, statesman, born in Turner, Me., June 9, 1836. He studied in the public schools and took a course of law at Portland, and in 1857 was admitted to the bar. He was elected to Congress in 1868 and was reëlected four times. President Grant offered him the position of Postmaster-General in 1874, but he declined, and two years later he refused to accept the appointment as Secretary of the Navy offered him by President Hayes. In 1881 he was elected to the Senate as successor to Hannibal Hamlin, and was reëlected in 1887, 1893, 1899, 1905, 1911, and 1917. During his long official service he exercised a wide influence upon the policies of the Republican party and the legislation of the nation. He died Oct. 27, 1918.

HALE, John Parker, statesman, born in Rochester, N. H., March 31, 1806; died Nov. 19, 1873. After attending Phillips Exeter Academy, he studied at Bowdoin College, where he graduated in 1827. He was admitted to the bar in 1830, elected State representative in 1832, and served as a Democratic representative in Congress in 1843-45. In 1846 he was chosen United States Senator, serving until 1853, and was Senator again from 1855 to 1865. He was the candidate for President of the Free Soil party in 1852, receiving 157,685 votes. President Lincoln appointed him minister to Spain in 1865. His public service is noted for the numerous pathetic and humorous speeches delivered in the Senate and his untiring opposition to slavery.

HALE, Sir Matthew, jurist, born at Alderley, England, Nov. 1, 1609; died Dec. 25, 1676. He graduated at Oxford and studied law at Lincoln's Inn, and in 1637 was admitted to the bar. In 1654 he was elected to Parliament and took an active part in the restoration of Charles II., who knighted him in 1660. Ten years later he was made Chief Justice. Though a man of devout religious character and wide learning, he believed in the existence of witches, and a number of persons were convicted and sentenced for witchcraft after being tried in his court. He published a number of works on English law. These publications include "Analysis of Law," "History of the Pleas of the Crown," and "History and Analysis of the Common Law."

HALE, Nathan, soldier and hero, born in Coventry, Conn., June 6, 1755; died in New York, Sept. 22, 1776. He graduated from Yale in 1773, engaged in school teaching, and enlisted as a volunteer in the Revolutionary War, attaining the rank of captain. Shortly after he visited the British camps in New York and Long Island disguised as a schoolmaster to obtain information for Washington, but, when about to return, the British arrested him as a spy, tried, and executed him. His last words were: "I only regret that I have but one life to lose for my country." Statues have been erected to his memory in City Hall Park, New York, and at Hartford, Conn.

HALÉVY (ä-lä-vē'), **Joseph,** explorer, born in Andrianople, Turkey, Dec. 15, 1827. He de-

scended from French parents and studied Semitic languages in Adrian and Bucharest, and later took advanced work in Paris. In 1868 he engaged as commissioner for the Alliance Israélite Universelle to study the condition of the Fallasha, of Abyssinia, a branch of the Jewish religion. The following year he was sent by the French government to the southwestern part of Arabia, the Arabia Felix of the Romans, now called Yemen, where he investigated archaeology and deciphered several hundred inscriptions. Subsequently he studied the history and ruins of ancient Assyria, devoted much time to biblical criticism, and contributed to periodical literature. His publications include "Religious Documents Concerning Assyria and Babylonia," "Critical Researches Concerning the Origins of Babylonian Civilization," and "Critical and Historical Miscellany about Semitic People."

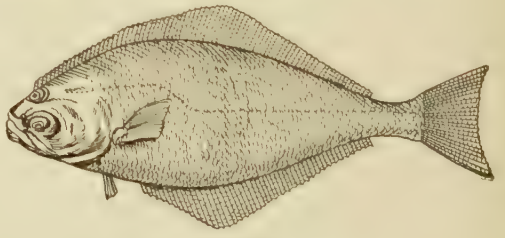
HALÉVY, Ludovic, dramatist, born in Paris, France, Jan. 1, 1834; died May 8, 1908. His father, Leon Halévy (1802-1883), attained success as a poet and dramatist. He was of Jewish extraction. After Ludovic completed his studies in Paris, he was attached to the ministry of state, and later became secretary of the colonial ministry. His writings first became known in 1861 and take high rank among European productions. In 1886 he was admitted to the French Academy. His most successful work is an idyllic story entitled "L'Abbe Constantin," which has gone through 200 editions and has been widely translated. In 1900 he was decorated as a chevalier of the Legion of Honor.

HALF TONE, a kind of plates made from photographs and engravings, used extensively in the illustration of books and periodicals. The best half tones are made from photographs, but they can be obtained by the reproduction of engravings and drawings. The process consists mainly in making a negative of the picture to be reproduced, which is done by a camera having a screen of two glass plates that are ruled diagonally with very fine parallel lines. When the plates are placed together, the lines form diamond-shaped checks. They are held together with some resinous substance, such as Canada balsam, and in the camera are placed near the plate that is to contain the negative. The purpose of the screen is to produce the shadow effect in the half tone.

The negative is developed and placed face downward upon a sensitized copper plate, which is prepared by carefully polishing the surface and covering it with a thin film of sensitized material. The action of light causes this material to harden. When the negative and the plate are exposed for a short time to a strong electric light, certain chemical changes take place and the picture is reproduced upon the copper. It will be seen that some portions of the sensitive film were not acted upon and that different parts were affected differently, hence by washing, the portions not acted upon are reduced, while those acted upon remain to protect the surface of the copper. After placing the plate thus prepared in an acid bath and etching it, the surface is cleaned and the plate is mounted on a block for printing. Screens having about 200 lines to the square inch make good half tones, but coarser screens are generally better when the surface of the paper used in printing is not of a fine quality.

HALIBURTON (hăl'ĭ-bûr-t'n), **Thomas Chandler,** author, born at Windsor, Nova Scotia, in 1796; died Aug. 27, 1865. He studied at King's College in his native city and in 1820 was admitted to the bar. In 1828 he became chief justice of the court of common pleas in Nova Scotia and of the supreme court in 1840. He removed to England in 1856, where he entered Parliament as a Conservative in 1859. He is best known by his literary work entitled "Sam Slick," which gives an account of a Yankee clockmaker of that name, and became popular because of the wit and shrewd sayings attributed to him. From it Haliburton obtained his pseudonym, *Sam Slick.* In the latter part of his life he was an attaché of the United States legation in London. Among his numerous writings are "Nature and Human Nature," "Wise Saws and Modern Instances," "Rule and Misrule of the English in America," "Letter-Bag of the Great Western," "Bubbles of Canada," "Traits of American Humor," and "An Historical and a Statistical Account of Nova Scotia."

HALIBUT (hŏl'ĭ-bŭt), a genus of fish allied to the turbot, so called because it was formerly eaten extensively on holidays. It is among the largest of flat fishes, specimens often weighing 600 pounds or more. Though esteemed for its food qualities, it is considered inferior to the turbot. The genus is characterized by having both eyes on the same side of the head. The lips are large and fleshy. Nearly all species are



HALIBUT.

dark brown on the upper surface, have small smooth scales, and the lower surface is white. The oil is valued and is extracted largely from the bones. Halibut fisheries are especially productive off the northeastern coast of North America, Iceland, the Scandinavian peninsula, and Western Europe, though various species are distributed widely in the Pacific.

HALIFAX (hăl'ĭ-făks), a town in the County of York, England, situated on the Hebble River, 38 miles southwest of York. It contains

numerous substantial buildings, has municipal facilities of importance, and is connected by important railroad lines. The noteworthy buildings include All Souls' Church, the townhall, the Blue Coat School, the Heath Grammar School, and an observatory. It has a public library, a market house, public baths, and electric railways. Among the manufactures are woolen goods, carpets, chemicals, ironware, and machinery. The large output of carpets and worsted goods has given the town an extended reputation. Halifax was governed under the manor rule until 1848, when it received its charter. Population, 1921, 101,556.

HALIFAX, a seaport city and the capital of Nova Scotia, on a small peninsula in Halifax harbor, on the Atlantic coast. It is on the Canadian National, the Halifax and Eastern, and other railways. The harbor offers easy access and anchorage for the largest sea-going vessels. It is the principal harbor and naval station of the British possessions in America, is strongly fortified, and has an extensive export and import trade. The noteworthy buildings include the Dominion Building, the Provincial

VICINITY OF HALIFAX, N. S.

Parliament, the Saint Paul's church, the Roman Catholic cathedral, and the Halifax Hotel. In 1917 nearly half the city was wrecked and 1,226 lives were lost by an explosion of ammunition on the French steamer Blanc, following a collision with the Belgian steamer Imo. Halifax was founded in 1749 and supplanted Annapolis as the capital in 1750. Population 1901, 40,832; in 1921, 58,372.

HALIFAX, Charles Montagu, statesman and financier, born at Horton, England, April 16, 1661; died May 19, 1715. He was educated at Trinity College, Cambridge, and in 1689 was elected to Parliament, where he voted for the declaration that James II. had abdicated. In 1692 he was made commissioner of the treasury and six years later became lord of the treasury. The principal events of his incumbency include the refunding of the national debt and the establishment of the Bank of England in 1695. He was made Baron Halifax, but was twice impeached by the House of Commons, though the impeachments were dissolved by the lords. He helped to promote the union between England and Scotland. George I. made him Premier and created him Earl of Halifax. He is the author of several poems, including "The Town and Country Mouse."

HALL, Asaph, astronomer, born in Goshen, Conn., Oct. 15, 1829; died Nov. 23, 1907. He studied in the common schools, worked as farmhand and carpenter, and in 1853 took a course at Norfolk Academy. Subsequently he taught in the public schools of Wisconsin and attended the University of Michigan. In 1857 he was made assistant in the observatory of Harvard University, and in 1862 became aid in the naval observatory at Washington, where he was afterward appointed professor of mathematics. In 1870 he went to Sicily to observe eclipses, and subsequently made like trips to Vladivostok, to Texas, and to Colorado, and in 1877 discovered Phobos and Deimos, the two satellites of Mars. The Astronomical Society awarded him a gold medal in 1878, and he was honored by membership in many scientific associations. The American Association for the Advancement of Science elected him president in 1902.

HALL, Charles Francis, Arctic explorer, born in Rochester, N. H., in 1821; died Nov. 8, 1871. After learning the trade of a blacksmith, he became a journalist in Cincinnati. In 1859 he volunteered to accompany an Arctic expedition in search of Franklin and accordingly organized the exploring party the following year. After cruising through the northern ice fields, the vessel became blocked and Hall remained with the Eskimos for two years, adopting their habits and language. A second expedition was organized by him in 1864, with which he remained among the Eskimos for five years. The United States government fitted out the steamer *Polaris* at his suggestion in 1871 for the purpose of making further search for Franklin, and, if possible, to reach the North Pole. With this vessel he left New York on June 29, 1871. In August he reached Lat. 82° 16′ north and returned to Lat. 81° 38′ for the purpose of wintering, where his death occurred. After many trying adventures and privations, the remaining crew abandoned the *Polaris,* reaching Littleton's Island in 1872, and in June, 1873, the party were rescued by a whaler. The experiences of the first expedition were narrated by Hall in his "Arctic Researches" and "Life Among the Eskimos," while the scientific results of the unfortunate expedition in which his life was lost were published by the United States. Dr. Emil Bessels, a member of the scientific staff, afterward published them in German.

HALL, Granville Stanley, philosopher and educator, born at Ashfield, Mass., Feb. 1, 1846. He graduated at Williams College in 1867, and subsequently studied at the German universities in Berlin, Heidelberg, and Leipzig. On returning to America, he was made professor of psychology in Antioch College, Ohio, held similar positions at Harvard and Williams, and in 1884 became professor of psychology at Johns Hopkins University. In 1888 he was made president of Clark University, Worcester, Mass., where he labored with eminent success a long term of years. He contributed many volumes of important writings on the subject of education and lectured extensively on the theory and methods of teaching. In the field of child study he exercised a wide influence and contributed to many scientific and educational periodicals. His books include "Aspects of German Culture," "Adolescence," "Hints Toward a Select and Descriptive Bibliography of Education," "Contents of Children's Minds." He died April 24, 1924.

G. STANLEY HALL.

HALL, John, clergyman, born in Market Hill, Ireland, July 21, 1829; died in Bangor, Ireland, Sept. 17, 1898. He descended from Scotch parentage, was educated at Belfast College, and in 1849 was licensed to preach by the Presbyterian Church at Belfast. After serving as missionary in Ireland, he preached successively at Armagh and Dublin, and became a commissioner of education for Ireland. In 1867 he visited America and was called to the pastorate of the Fifth Avenue Presbyterian church in New York, a position he held until his death. Dr. Hall ranks as one of the most effective ministers of the Presbyterian Church. He was a devoted adherent to the Calvinistic faith and opposed the liberal movement led by Doctor Briggs. His success was due to his simplicity of manner, sincerity, and spiritual devotion to religion. Among his publications are "Familiar Talks to Boys," "Prayers for Four Weeks," "The Christian Home and How to Maintain It," "God's Word Through Preaching," and "Light unto My Path."

HALL, Robert, minister and writer, born in Armsby, England, May 2, 1764; died Feb. 21, 1831. After completing a course of study at the Bristol Baptist Academy, he secured a liberal education at King's College, Aberdeen, where he graduated in 1785. His pleasing and fluent ability as speaker attracted large audiences and gave him a high rank among the pulpit orators of England. In 1790 he was called to Cambridge, where he remained until 1806. Subsequently he settled in Leicester and in 1825 took up his residence at Bristol, where he died. Among his publications are "Modern Infidelity," "Apology for the Freedom of the Press," and "The Terms of Communion."

HALLAM (hăl'ląm), **Henry,** historian, born in Windsor, England, July 9, 1777; died in Pickhurst, Jan. 21, 1859. He was educated at Eton and Oxford and studied law at Lincoln's Inn, but soon after became interested in literature. In 1818 he published "A View of Europe in the Middle Ages," by which he attained a high station among the historians of England. His works are characterized by patient research, accuracy, impartiality, and profound learning. His writings include "Constitutional History of England," "Introduction to the Literature of Europe," and numerous essays published in magazines. Arthur Henry (1811-1833), his youngest son, was a young man of remarkable intellect, but died at the early age of 22 years. His chief work, "Remains in Prose and Poetry," was published in 1834. He was made the subject of the poem, "In Memoriam," by Tennyson.

HALLE (hăl'lę), a city of Germany, in Prussian Saxony, on the Saale River, twenty miles northwest of Leipzig. It is an important railroad center, has well-improved and wide streets, and is the converging center of many electric lines. As an educational center it has long taken high rank. The celebrated university located here has been famous since the 17th century. Other noteworthy buildings include the Church of Saint Maurice, the Market Church, the townhall, the normal school for teachers, and the central railroad station. It has fine statues of Handel, Roland, and other prominent personages. The city has fine public school buildings and several equestrian monuments. Among the manufactures are chemicals, machinery, dies, oil, and malt. Within the vicinity are extensive mineral springs that yield great quantities of salt. Halle contained a castle as early as the 8th century. It was important as a member of the Hanseatic League and was a stronghold of Lutheranism in the Reformation. The French captured it in 1806, but it was annexed to Prussia in 1813. Population, 1905, 169,916; in 1920, 180,551.

HALLE, University of, an institution of higher learning at Halle, in the province of Saxony, Germany. It was founded as a Lutheran center of education in 1694, when it had over 700 students. It has taken high rank as a theological school since the beginning. During the Napoleonic wars it was twice suspended, but was shortly after reopened, and the University of Wittenberg was united with it in 1817. The library has over 215,000 volumes. In 1909 it had 2,150 students, including a large number from foreign countries. The names of Francke, Gene-

sius, and Schleiermacher are closely associated with this institution.

HALLECK (hăl'lĕk), **Fitz-Greene,** writer and poet, born in Guilford, Conn., July 8, 1790; died there Nov. 19, 1867. He descended from John Eliot, the apostle of the Indians, by his mother, and became a clerk in a store at Guilford and later in a banking house in New York City. In 1819 he formed an acquaintance with Joseph Rodman Drake and assisted in contributing to the New York *Evening Post,* writing over the signature of Croaker & Co. John Jacob Astor appointed him private secretary in 1822 and left him an annuity which enabled him to retire in 1849 to his native town. The writings of Halleck show much care and finish, possess a fine degree of harmony, and are noted for their elevated and genial sentiment. His visit to Europe in 1822-23 enabled him to enrich his productions by coming in contact with many historical places. Among his best known writings are "To the Memory of Burns and Alnwick Castle," "Marco Bozzaris," "Young America," and "Fanny."

HALLECK, Henry Wager, general, born in Westernville, N. Y., Jan. 16, 1815; died Jan. 9, 1872. In 1839 he graduated from West Point, enlisted for service in the Mexican War, and on account of gallantry was brevetted captain in 1847. In 1853 he became captain of engineers, but the next year left the army and settled in San Francisco as a lawyer and director of a mining company. At the beginning of the Civil War he was commissioned major general in the army, and in 1861 was placed in command of the Department of the Missouri. The following year he directed the military operations in the West, and, when the Battle of Shiloh had been fought, secured command of the entire force sent against Corinth. In July of the same year he became commander in chief, which position he held until he was superseded by General Grant in March, 1864. After the war closed he commanded the Pacific division until 1869 and subsequently the division of the south until 1872. He published "Elements of Military Art and Science" and several works on international law.

HALLELUJAH (hăl-lĕ-lū'yà), or **Halleluiah,** an ascription of adoration to God, occurring at the commencement of many psalms, meaning praise ye Jehovah. It is a doxology in the Jewish synagogues and was probably retained in Christian translations on account of its signification and poetic sound. The name has been adopted for many musical productions, as the *Hallelujah Chorus* in Handel's "Messiah," which is considered a masterpiece of choral music.

HALLER (hăl'lĕr), **Albrecht von,** scientist and poet, born at Bern, Switzerland, Oct. 16, 1708; died Dec. 17, 1777. He studied at the University of Tübingen and later took a course in medicine at Leyden. In 1728 he went to Basel, where he studied medicine, and afterward made a botanical exploration of the Alps. For some time he practiced medicine at Bern and in 1736 became professor at Göttingen. He was made physician to the King of England in 1729 and after 1753 lived in retirement at Bern. His writings include a large number of scientific works and several poetic productions of merit. He is classed among the leaders of the modern school of German poetry. The Emperor of Germany ennobled him in 1748.

HALLEY (hăl'lĭ), **Edmund,** astronomer and mathematician, born at Haggerston, England, Oct. 29, 1656; died Jan. 14, 1742. He studied at Queen's College, Oxford, where he made a creditable record, and in 1676 began to publish interesting papers on the planets and other heavenly bodies. He visited Saint Helena the following year to catalogue the southern stars, discovered the great comet which bears his name, and soon after published his theory of the variation of the magnet. In 1669 he was made a captain in the royal navy and four years later accepted a professorship at Oxford. He was appointed royal astronomer in 1720. His discoveries include the acceleration of the motion of the moon and the law which governs the return of comets.

HALL OF FAME, a building at University Heights in New York City, on the grounds of the New York University. It is one of the buildings inclosing the campus, consists of a colonnade about 500 feet in length, and is built about the library. It contains 150 panels, in which will be set bronze tablets for the names of that number of great Americans. The selection of the subjects to be honored is intrusted to a committee of 100, made up of college presidents, educators, chief justices, and others, the selections finally to be approved by the senate of the New York University. Originally only persons born in the United States and deceased at least ten years were eligible, but in 1904 an apartment was set aside for women and foreign-born Americans. Twenty-nine names were chosen in 1900, eleven others were selected in 1905, and five will be added every fifth year, until in the year 2000 the roll of 150 shall be complete. Helen Gould made a liberal gift toward constructing the Hall of Fame, which will cost $250,000 when fully completed.

The names selected in 1900 and 1905 are: George Washington, John Adams, John Quincy Adams, Benjamin Franklin, Thomas Jefferson, Alexander Hamilton, James Madison, Henry Clay, Daniel Webster, Abraham Lincoln, John Marshall, James Kent, Joseph Story, John Paul Jones, Ulysses S. Grant, William T. Sherman, Asa Gray, David G. Farragut, Robert E. Lee, Robert Fulton, Eli Whitney, Samuel F. B. Morse, John Audubon, Louis Agassiz, Jonathan Edwards, Horace Mann, William E. Channing, Henry Ward Beecher, Washington Irving, Nathaniel Hawthorne, Ralph Waldo Emerson, Henry W. Longfellow, James R. Lowell, John G. Whittier, Gilbert Stuart, Peter Cooper,

George Peabody, Mary Lyon, Emma Willard, and Marie Mitchell. Ten names were added in 1910, nine in 1915, seven in 1920, and two in 1925.

HALLOWEEN (hăl-lō-ēn'), an abbreviation of *Alle halowene tyd,* meaning all hallows tide, and applied to the evening of October 31 on account of that day being the eve or vigil of All Saints, which occurs on November 1. In some countries it is a time for evening entertainments, and frequently jokes are played on unsuspecting persons. Burns made it the subject of his poem "Hallowe'en."

HALLUCINATION (hăl-lū-sĭ-nā'shŭn), a mental sensation which has no corresponding external cause, or the perception of objects which have no reality. This phenomenon is due to a disorder of the nervous system, as in a case of delusion or delirium tremens. In general, delusions differ from hallucinations, especially in that the former may arise from an error in interpreting a real sensation, while a hallucination arises from a derangement of some mental faculty. While all the senses may be affected, hallucinations are most closely associated with the sense of hearing. Rest and regularity in habits are recommended as essentials in the treatment.

HALO (hā'lō), a circle of light seen frequently around the sun and moon, caused by the presence in the air of small particles of ice and snow, by which the rays of light are reflected. refracted, dispersed, and diffracted. Smaller and less distinct halos are caused by raindrops and vapors constituting clouds. There are at least three distinct forms of these phenomena; *halos* proper, caused by the snow and ice particles; *coronas,* circles of light caused by condensed vapor; and *paraselenae,* mock moons that appear on a lunar halo and resemble suns or moons. A fourth halo, observed by aëronauts on the upper surface of clouds, is called *aureola.*

HALPINE (hăl'pĭn), **Charles Graham,** known also as Miles O'Reilly, soldier and author, born at Old Castle, Ireland, Nov. 20, 1829; died Aug. 3, 1868. He graduated from Dublin Trinity College in 1846, came to New York in 1852, and was associated at different times with the *Herald, Times,* and *Tribune.* He enlisted at the beginning of the Civil War, serving in many of the important battles. Subsequently he was made assistant adjutant general on General Halleck's staff, receiving the brevet of brigadier general of volunteers. He published "Baked Meats of the Funeral," "Lyrics by the Letter H," and "Poetical Works of Charles G. Halpine."

HALS (häls), **Frans,** painter, born at Antwerp, Holland, about 1584; died in 1666. He studied under Rubens and lived the greater part of his life in Antwerp and Haarlem. His works are very numerous, especially his portraits, and he is counted the greatest Dutch portrait painter next to Rembrandt. Many of his finest works are in private collections, since they have been sought by wealthy men on account of their moderate size and because the painting was done solidly so as to be preserved in a good state for many years. Among his most noted productions are "The Jolly Topers," "Hals and His Wife," "Banquets of the Haarlem Marksmen," "Portrait of Descartes," "Hille Bobbe," "Fool Playing a Flute," "Young Married Couple," "Nurse with Child," and "Lady Governors of the Hospital for Old Women."

HALSTEAD (hal'stĕd), **Murat,** journalist, born in Paddy's Run, Ohio, Sept. 2, 1829; died July 2, 1908. He was reared on a farm, graduated from Farmer's College in 1851, and became a district school teacher. In 1853 he reported for the Cincinnati *Commercial,* of which paper he became proprietor in 1857. He gained a wide reputation for his fearless, independent editorials. Later he was owner of the *Standard-Union* of Brooklyn, New York, and had official connection with other newspapers. In 1896 he published "The Story of Cuba," which created sympathy for the insurgents, and after the war with Spain wrote "History of the Cuban People."

HAM, the thigh of an animal, such as that of the hog, sheep, or ox, but especially the thigh of the hog when cured by salting and smoking. The curing of hams is an important part of slaughtering and meat packing, since this class of meat is considered among the best obtained from domestic animals. Hams are first pickled in brine and then smoked by burning wood, hickory being preferred, and in some cases powdered mahogany is added to the burning. See **Bacon.**

HAM, the youngest of the three sons of Noah and father of Cush, Canaan, Phut, and Mizraim. Canaan was the progenitor of the people of Palestine and Phoenicia, and the three others of the native inhabitants of Africa.

HAMATH (hā'math), or **Hamah,** an ancient city of Syria, on both sides of the Orontes River, frequently mentioned in the Old Testament. It is situated in a fertile valley, about 110 miles north of Damascus. The manufactures include flour, clothing, carpets, woolens, and jewelry. Though once a city of vast importance politically and commercially, it is now less fortunate. About 10,000 of the inhabitants are Greeks and fellahs. Population, 1922, 48,503.

HAMBURG (hăm'bûrg), a free city of Germany, on the north branch of the Elbe, about eighty miles from the North Sea. The site of the city proper has an area of 30 square miles, but the region included in the state of Hamburg embraces 159 square miles. With it are included a number of contiguous districts and the island of Neuwerk, in the estuary of the Elbe. Many orchards, gardens, and dairy farms surround the city.

Hamburg is the most important commercial city of continental Europe, having a fine harbor, wharves, and steamboat connections. It contains excellent public institutions, numerous cen-

ters of higher learning, several libraries, observatories, and botanical gardens. Among the chief buildings are the Exchange, the government house, the townhall, the churches of Saint Michael and Saint Nicholas, and the public library of 115,000 volumes. It has monuments of Lessing, Schaper, Schilling, and the soldiers who fell in the Franco-German War. Besides electric railways, it has waterworks, electric lighting, boulevards, sewerage, and many parks. The importance of its harbor is increased by convenient railroad and canal facilities. As a money exchange it is, next to London, the most important of Europe. Among the manufactures are sugar, spirituous beverages, scientific instruments, cured meats, engines, machinery, cotton, woolen, and silk goods, cordage, and tobacco. Its shipbuilding yards are extensive and of vast importance.

Educationally Hamburg is in a flourishing condition. In religion the people are largely Protestant. It dates from 809, when it was founded by Charlemagne. However, its commercial importance began in 1189, at which time it was made a free city. In 1241 it led in the formation of the Hanseatic League of towns and soon after increased its territory. It was occupied by the French in 1806, annexed to France four years later, and, when French dominion ceased in 1814, it had lost much of its commercial importance. In 1815 it became one of the four free cities of the German Confederation, and since then has enjoyed phenomenal prosperity, though vast damage was done by a fire in 1842. It includes the suburban towns of Cuxhaven, Ritzebuttel, and several others. These and Hamburg proper constitute the most important passenger and emigrant center of Northern Europe. Population, 1920, Hamburg City, 932,078; Hamburg State, 1,015,707.

HAMERTON (hăm'ĕr-tŭn), **Philip Gilbert**, etcher and writer on art, born in Manchester, England, Sept. 11, 1834; died Nov. 6, 1894. He visited among the highlands of Scotland at an early age to study landscape painting from nature, and while there married a French lady. Later he resided in France, which accounts for his productions being largely concerned with the literature and thought of that country. After studying art in various European countries, he founded *The Portfolio* in 1869, a magazine of interest to artists. His principal works include "Thoughts About Art," "Chapters on Animals," "Etchings and Etchers," "Modern Frenchmen," "Man in Art," "Human Intercourse," "Contemporary French Painting," "Drawing and Engraving," and "The Intellectual Life." His writings show a keen discrimination, a wide range of knowledge, and a sympathetic interest in literature. A collection of his chief productions was published in Boston in fourteen volumes about the time of his death.

HAMILCAR (hà-mĭl'kär), the name of several Carthaginian generals, the most celebrated of whom was Hamilcar, surnamed Barca, the father of Hannibal. In 247 B. C. he became commander of the Carthaginian forces in Sicily, after the Punic War had raged about eighteen years and the Romans had conquered the larger portion of the island. His first success was in seizing an elevated hill called Mount Hercte, which he made the base for his subsequent operations. Within the next three years he attained much military renown and ravaged the coast of Italy, but after the defeat of Hanno, the Carthaginian admiral, in 241, he evacuated Sicily. After the Carthaginian army was withdrawn, an insurrection broke out under the leadership of mercenaries and native Africans, which he suppressed in 238. Shortly after these successes he invaded Spain and founded an empire for Carthage. After operating there nine years, bringing the southeastern part of the Iberian peninsula under the rule of Carthage, he was slain in battle, in 229 B. C., while opposing the Vettones. His son, Hannibal, succeeded him in command of the army and carried forward the war against Rome with even greater determination.

HAMILTON (hăm'ĭl-tŭn), a town of Australia, capital of Dundas and Normanby counties, in the western district of Victoria. It is located on Grange Burn Creek, fifty miles northeast of Portland, and is surrounded by a fertile farming and stock-raising country. It has electric lights, waterworks, and railroad connection with the principal cities of Australia. The chief buildings include several churches and schools and a number of structures erected for city and county governmental purposes. Population, 1901, 4,026; in 1921, 4,900.

HAMILTON, a town on Hamilton Island, capital of the Bermudas. It has a safe and commodious harbor and is the seat of a considerable trade in fruit, sugar, and merchandise. The place was founded in 1790. Population, 1921, 2,246.

HAMILTON, a city in Ohio, county seat of Butler County, on the Great Miami River, 25 miles north of Cincinnati. It is on the Miami and Erie Canal and on the Pennsylvania, the Baltimore and Ohio, the Erie, the Grand Rapids and Indiana, and other railroads. Many of the streets are finely paved, lighted by gas and electricity, and improved by sewerage, waterworks, and avenues of trees. The noteworthy buildings include the county courthouse, the public library, the high school, and several charitable institutions. The chief manufactures are stoves, steam engines, candy, laundry machinery, hosiery, earthenware, vehicles, furniture, cordage, glass, sugar, bread, and textile fabrics. It has a large trade in farm produce and merchandise. The place was settled in 1791, when Gen. Arthur Saint Clair built Fort Hamilton, and it was incorporated in 1810. Population, 1900, 23,914; in 1920, 39,675.

HAMILTON, the capital of Wentworth

County, Ontario, Canada, at the west end of Lake Ontario, seventy miles northwest of Buffalo, N. Y. It is on the Canadian National, the Canadian Pacific, and other railways. The site is a fine tract on Burlington Bay, an inlet from Lake Ontario, and the port is connected with deep water by a canal through a sand bar, which serves as a breakwater for the inner harbor. It has regularly platted and well-graded streets,

VICINITY OF HAMILTON, ONT.

many of which are paved with stone and macadam. The chief buildings include the county courthouse, the Dominion post office, the townhall, and many fine schools and churches. It has a public library, gas and electric lighting, systems of waterworks and sewerage, and intercommunication by electric railways. The race course is one of the finest in America. As a manufacturing center it takes high rank among Canadian cities, the products including canned goods, flour, ironware, machinery, glassware, cotton and woolen goods, shoes, and musical instruments. Hamilton was platted in 1813, but its larger growth has been realized within the past two decades. Population, 1921, 114,151.

HAMILTON, Alexander, American statesman, born in Nevis, an island of the West Indies, Jan. 11, 1757; died July 12, 1804. He was

ALEXANDER HAMILTON.

of Scotch-French descent and when twelve years old secured employment at Saint Croix in the store of a merchant. Soon after his marked natural abilities attracted the attention of his friends, who raised a fund and sent him to school at Elizabeth, N. J., and when sixteen years of age he entered Columbia College, New York, as a student. While at college he wrote a number of articles in behalf of the American colonies, which were so ably composed that they were attributed to John Jay. In 1774 he delivered a public address in behalf of the Revolutionists that showed remarkable ability for a boy of seventeen, and later published a number of circulars relative to the American cause. He became captain of artillery at the beginning of the Revolution, was appointed a member of Washington's staff in 1777, and rendered valuable aid as a friend and adviser.

In December, 1780, he married Elizabeth Schuyler, daughter of General Schuyler, and the following year resigned his membership on the staff. After the war closed he studied law, served in the Continental Congress in 1782-83, and rose to eminence at the New York bar. In 1787 Hamilton served as a leader at the constitutional convention in Philadelphia, where he advocated a strong central government, but accepted the Constitution agreed upon, and by voice and pen supported that document, defining its scope and power before the people. His papers on the Constitution were published under the title of *The Federalist,* and of the eighty-five issues that appeared fifty-one were from his pen. The convention which met in New York in 1788 to consider the Constitution was at first opposed to ratification by a two-thirds majority, but this was reduced to a minority by his able advocacy.

Washington selected him as Secretary of th Treasury in 1789, in which position he displayed rare ability in raising the public credit and placing the nation on a stable financial basis. In the Cabinet he was confronted by Jefferson, who differed from him in the construction placed on the Constitution, which led Hamilton to resign his office in 1795, but he became an active and influential leader of the Federal party. He wrote the famous "Camillus" letters in defense of the Jay Treaty, advised Washington in preparing the address of farewell, and was personally opposed to President Adams. Political differences with Aaron Burr brought on a duel with the latter at Weehawken, N. J., July 11, 1804, and he died the following day from the effect of the wound he received. Hamilton ranks in history among the most brilliant statesmen of America, being remarkable alike for his extraordinary genius and ability to organize.

HAMILTON, Sir William, philosopher, born in Glasgow, Scotland, Mar. 8, 1788; died May 6, 1856. He studied philosophy at Glasgow and Balliol College, Oxford, and became noted as a student of logic and literature. In 1813 he was admitted to the bar of Scotland and soon after took up his residence at Edinburgh. He remained in his native country practically his entire life, making only two visits to Germany in 1817 and 1821. In 1820 he became professor of civil history in the University of Edinburgh and in 1829 published his noted essay on the "Philosophy of the Unconditional." In this contribution to science he discussed the system of philosophy announced by Victor Cousin, and it formed one of a series of articles contributed to

the Edinburgh *Review*. He became professor of logic and metaphysics at Edinburgh in 1836, where he exercised a wide influence upon the education of his generation for twenty years. His principal works are "Lectures on Metaphysics and Logic," "Discussions on Philosophy and Literature," and "The Works of Thomas Reid."

HAMITES (hăm'īts), or **Hamitic**, the name of a race of people in the northern part of Africa, so named because they are supposed to have descended from Ham. They belong to the white or Caucasian branch of the human family and were the earliest to develop a high civilization. In language they are related to the Semites, but there are three principal dialects, those known as the Berber, Egyptian, and Ethiopian. Though Egypt is supposed to have been their original seat, they extended their settlements to the Canary Islands and southward on the continent to the southern limits of German East Africa. At present they are divided into numerous branches, many of which are strongly negroid. They include principally the Copts, Gallas, Berbers, Kabyles, Tuaregs, Tubus, Falashas, Somalis, Danakils, and Guanches.

HAMLET (hăm'lĕt), or **Amleth**, the hero of Shakespeare's drama. Writers differ as to the place occupied in history by Hamlet. Some regard him an historical personage, while others look upon him as a mere development of the system of Scandinavian mythology. Saxo Grammaticus (d. 1204) regarded him a prince of Denmark, who lived about 200 B. C., and associated with him the early development of Jutland. His account is taken as the basis for the noted drama of Shakespeare, though the latter varies from it in many of the details. The *sagas* of Iceland contain an account of two persons by the name of Hamlet, but the historians of Denmark do not consider the history of Hamlet, which makes him a prince of that country, as authentic.

HAMLIN (hăm'lĭn), **Hannibal**, statesman, born in Paris, Me., Aug. 27, 1809; died in Bangor, July 4, 1891. He began his career as a printer, was admitted to the bar in 1838, and served in the Legislature in 1836-40 and again in 1847. In 1842-44 he was a member of the national Congress and in 1848-57 held a seat in the United States Senate. Up to 1856 he was a Democrat, but in that year he aided in organizing the Republican party, being in favor of the immediate abolition of slavery. In 1860 he was elected Vice President of the United States, serving with Lincoln in 1861-65. President Johnson appointed him collector of customs at Boston. He was United States Senator in 1869-81 and in 1881-82 was minister to Spain.

HAMM, a city of Germany, in Westphalia, on the Lippe River, 23 miles northwest of Arnsberg. It is important as a railway junction and manufacturing center. The streets are regularly platted and well paved. It has a church which dates from 1510. The manufactures include gloves, leather, machinery, clothing, and brick and tile. It was for many years an important member of the Hanseatic League. Population, 1922, 38,429.

HAMMER, an instrument for driving nails or beating metals, consisting of the head and the handle. The small hammers in use among blacksmiths have an iron or a steel head fixed to a wooden handle. One end of the head is usually larger than the other, one being fitted for drawing nails or for hammering larger pieces of metal than the other. The larger use of steam and electricity has caused power hammers to come into general use for manufacturing purposes, some of which are large machines, especially those used in forging iron and steel. See **Steam Hammer.**

HAMMOND (hăm'mŭnd), a city of Lake County, Indiana, on the Grand Calumet River, three miles from Lake Michigan and twenty miles southeast of Chicago. It is on the Erie, the Baltimore and Ohio, the Wabash, the Monon, the Michigan Central, and other railroads, and has direct connection with Chicago by electric railways. The noteworthy buildings include the Carnegie library, the Federal building, the courthouse, the public high school, and a number of fine churches. Among the industries are starch works, machine shops, iron foundries, flouring mills, car works, bakeries, and publishing houses. Many of the highways adjacent to the city have been finely macadamized. Among the public utilities are sewerage, waterworks, and street pavements. Hammond was settled in 1869 and incorporated in 1883. Population, 1900, 12,376; in 1920, 36,004.

HAMMOND, John Hayes, mining engineer, born in San Francisco, Cal., March 31, 1855. He was educated at Yale and Freiburg, Germany. In 1880 he secured an appointment in the department of mining and mineral statistics, California, and shortly after became mine superintendent in Mexico. In 1893 he was made expert mining adviser to Abraham Barnato, the largest mine owner of South Africa. He was one of the leaders of the uitlander reform agitation regarding the Transvaal, and, after the celebrated Jameson raid, was arrested on a charge of high treason. On April 27, 1896, he was sentenced to be hanged, but this was immediately commuted to imprisonment for fifteen years. Later the sentence was changed to a cash fine of $125,000 and banishment, after which Hammond went to England and gave testimony regarding the Jameson raid before a commission of Parliament. Subsequently he gave his attention chiefly to mining interests in Mexico and the United States.

HAMMOND, William Alexander, physician, born in Annapolis, Md., Aug. 28, 1828; died Jan. 5, 1900. He graduated from the University of New York as doctor of medicine in 1848, and served in the United States army as

assistant surgeon from 1849 to 1860, when he resigned to accept a professorship of anatomy and physiology in the University of Maryland. He entered the army at the beginning of the Civil War, and was made surgeon general in 1862 with the rank of brigadier general. Later he was dismissed from service on account of charges of irregularities in liquor contracts, but afterward was restored to full rank by the President and Congress. In 1867 he became professor in Bellevue Hospital Medical College, and lectured extensively on diseases of the nervous system in various important institutions of learning. Among his published works are "Sleep and Its Derangements," "Treatise on Hygiene," "Strong-minded Women," "Diseases of the Nervous System," "Physiological Memoirs," and "On the Susquehanna."

HAMPDEN (hămp'dĕn), **John,** statesman, born in London, England, in 1594; died June 24, 1643. He descended from prominent ancestors, and was related to Cromwell. His father, William Hampden, died when he was but three years old. In 1609 he entered Oxford as a student, inherited ample means from his father's estate, and in 1621 was elected to Parliament, serving three terms consecutively. In Parliament he took a prominent part, though not as an orator, but was influential because of his considerate judgment and force of character. With much decision he opposed the designs of Charles I. in his tax measures, was influential as a leader in the Long Parliament, and with four others precipitated civil war by attempting to seize King Charles on Jan. 4, 1642. The hostilities that followed received his personal and financial support, and he displayed superior generalship and marked bravery in behalf of the Parliamentary army. In the Battle of Chalgrove Field, fought June 18, 1643, he was fatally wounded while leading a gallant charge and died six days later. Hampden is mentioned by Macaulay as a capable soldier and statesman, and as giving promise of becoming the Washington that would establish a just government in England, had he not been cut short in battle.

HAMPTON (hămp'tŭn), a town of Virginia, county seat of Elizabeth City County, on the Chesapeake and Ohio Railroad. It is located on the north side of Hampton Roads, about two miles northwest of Fortress Monroe, and has considerable trade in oysters, fish, vegetables, and agricultural produce. The public institutions include the Hampton Normal and Agricultural Institute. It has the Church of Saint John built in 1660, a national soldiers' home, and a national cemetery where 3,325 bodies are buried. The first settlement on its site was made about 1610. Population, 1900, 2,764; in 1920, 6,138.

HAMPTON, Wade, soldier, born in South Carolina, in 1754; died Feb. 4, 1835. He became distinguished as a soldier in the American Revolution. After the close of the war he became a large slave-owner in his native State. He was elected to Congress in 1794 and in 1802. In 1809 he was raised to the rank of major general and commanded at New Orleans and on the Canadian frontier during the War of 1812. Subsequently he acquired great wealth as a planter in the South.

HAMPTON, Wade, soldier and statesman, grandson of the former, born in Charleston, S. C., March 28, 1818; died April 11, 1902. He studied at the University of South Carolina, from which he graduated with honors, and served in both branches of the Legislature. In 1861 he opposed the secession of his State, but was enthusiastic in support of the Confederacy after it was organized. When the war began, he raised the "Hampton Legion," a body of cavalry, infantry, and artillery that rendered efficient aid to the Confederate cause. During the service he rose from private to lieutenant general, commanded the cavalry under General Lee, and later held a command under Johnston. In 1878 he was elected Governor of South Carolina. He served as United States Senator with much ability in 1879-91, and in 1893 was appointed United States commissioner of railroads. Hampton takes high rank among the legislators and public men of the Southern States.

HAMPTON COURT CONFERENCE, a conference held at Hampton Court, an English royal palace on the north bank of the Thames. It met in 1604, shortly after the accession of James I., for the purpose of discussing religious differences with the Puritans. The latter had presented a petition for a more liberal use of the Prayer Book and other reforms within the church, but the king, angered by the use of the word presbyter, refused to grant the points petitioned for by the Puritan party. The last of the three sessions of the conference, held on Jan. 18th, was the beginning of Puritan opposition to the house of Stuart.

HAMPTON NORMAL AND AGRICULTURAL COLLEGE, an institution of general learning and industrial arts at Hampton, Va., to which only Negroes and Indians are admitted. It was opened in 1868 under the auspices of the American Missionary Association, under the direction of Gen. S. C. Armstrong, and received a state charter in 1870. The grounds contain 185 acres on the Hampton River, on which about 60 buildings are maintained, and five miles distant is a farm of 600 acres that is worked by students. Besides teaching the fundamental courses in educational work, instruction is given in carpentry, painting, blacksmithing, horticulture, agriculture, stock raising, and other industrial arts. The industrial department continues throughout the year, but the schools of general education have a vacation during the summer. About 60 per cent. of the graduates engage in teaching, but a large number become successful farmers, carpenters, blacksmiths, and workers in other lines.

Booker T. Washington, president of the Tuskegee Institute and Normal School, is one of the graduates. The institution has about 2,200 students, an annual income of $265,788, and a library of 59,665 volumes.

HAMPTON ROADS, an inlet from Chesapeake Bay, in Virginia, forming the mouth of the James River. The channel is wide and deep, amply sufficient to accommodate the largest vessels, and on its shores are many good harbors, including those of Norfolk and Newport News. On the northern shore is Fortress Monroe, which on March 8, 1862, was the scene of an important naval battle between the Confederate ironclad *Virginia,* previously called the *Merrimac,* and the Union vessels *Congress* and *Cumberland,* which resulted in the destruction of the latter two. On the following day the *Monitor,* a Union ironclad of a new type, appeared on the scene of battle, and after a fight of four hours compelled the *Virginia* to withdraw.

HAMPTON ROADS CONFERENCE, an informal conference of the United States, held on board of the *River Queen* near Fortress Monroe on Feb. 3, 1865. The purpose was to discuss the differences arising from the Civil War between the two sections of the country. President Lincoln consented to this meeting as a means of perpetuating the Union, in which he was aided by Secretary Seward, while the Confederacy was represented by Alexander H. Stephens, Vice President, Robert M. T. Hunter, and John A. Campbell. The meeting had been promoted by Francis P. Blair as a means of uniting the two sections with the view of abolishing slavery and expelling the French from Mexico. While Lincoln declared himself in favor of admitting the Southern States after their surrender, he expressed himself opposed to modifying the Emancipation Proclamation and to any treaty with the Confederate States as an independent government. No agreement was reached during the four hours that the conference was in session.

HAMSTER (hăm'stĕr), a genus of rodent animals closely allied to the rat, but belonging to the family of mice. The tail is short and the body is from eight to twelve inches long. They have large cheek pouches in which they carry grain and other food into their burrows. The food consists chiefly of cereals, vegetables and other forms of plant growth. Several of the species are noted for carrying corn and other seeds into their subterranean abodes for use as food in the winter. The common hamster ranges throughout the dry region of Europe and Asia.

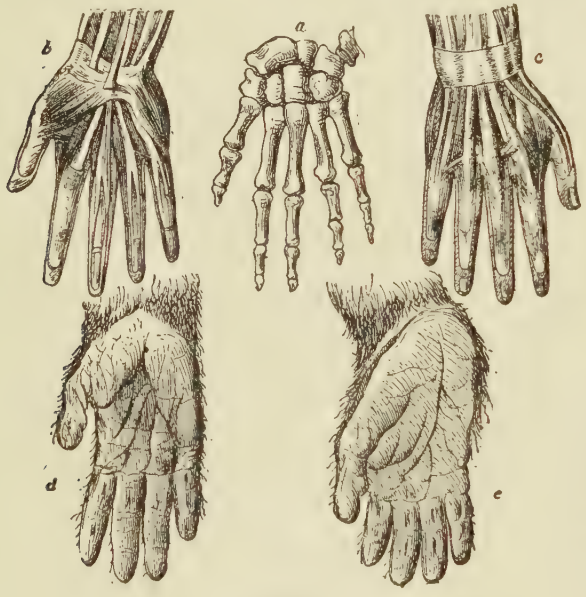
HANCOCK (hăn'kŏk), a town of Michigan, in Houghton County, on Lake Portage, opposite Houghton. It is located on the Duluth, South Shore and Atlantic Railroad and has transportation facilities by water through a ship canal to Lake Superior. The surrounding country is noted for its rich deposits of copper and near it are the famous Calumet and Hecla mines. It has foundries, smelting works, machine shops, and a large trade in merchandise. It is the seat of a Finnish college, has electric lighting and waterworks, and contains Montezuma Park. The place was settled in 1859 and incorporated in 1863. Population, 1920, 7,527.

HANCOCK, John, statesman, born in Quincy, Mass., Jan. 12, 1737; died Oct. 8, 1793. An estate inherited from an uncle enabled him to pursue the mercantile business, an occupation in which he became successful and amassed a large fortune. From 1766 to 1772 he served as a member of the Massachusetts Legislature, and there showed early tendencies toward a spirit of liberty. When the British attempted to seize his ship *Liberty,* a riot followed, and he was one of several commissioners who demanded that the British troops be removed from Boston after the Boston Massacre. He was elected to the Provincial Congress in 1774, and, when the proclamation of Governor Gage was issued in 1775, all revolutionists were promised pardon except Hancock and Samuel Adams. In 1775-80 and 1785-86 he represented Massachusetts in the Continental Congress, was president of that body in 1775-77, and his name stands first as a signer of the Declaration of Independence. During the Revolution he was major general, became first Governor of Massachusetts in 1780, a position which he held until 1792, except two years intervening, and in 1789 received four electoral votes for President. Hancock was a courtly and pleasing man, possessed a strong and popular character, and showed much liberality in using his large fortune for benevolent purposes.

HANCOCK, Winfield Scott, noted soldier, born in Montgomery County, Pa., Feb. 14, 1824; died Dec. 9, 1886. In 1844 he graduated from West Point, rendered distinguished service in Scott's campaign in Mexico, and did frontier duty until 1861, when he was appointed brigadier general of volunteers, commanding in the army of the Potomac. His service to the Union cause at South Mountain and Antietam was efficient and caused his promotion to the rank of major general, and in 1863 he was rewarded by a command in the second corps for distinguished bravery at Fredericksburg and Chancellorsville. At Gettysburg he won his greatest laurels by marked efficiency and at the moment of victory was severely wounded, but remained on the field until his corps repulsed the desperate charge led by General Pickett. His bravery was recognized in a vote of thanks by Congress. Early in 1864 he returned to take command of his corps, when he distinguished himself at the Wilderness, Spottsylvania, Cold Harbor, and Petersburg. In 1864 he was made brigadier general in the regular army, and after the close of the war commanded various departments, securing a promotion to the rank of major general in 1866.

The attitude of General Hancock during the period of reconstruction, particularly several orders issued in 1867, in which he declared military power is intended not to control, but uphold, civil power, brought him prominently before the country in 1880 as the Democratic candidate for the Presidency. However, he was defeated in the election by General Garfield, but retained the warm regard of the people. Subsequently he continued as senior major general of the army, directing the department of the Atlantic. As a general he stands among the bravest and most fearless of America, being noted alike for his manliness and devotion to country. General Grant said of him: "Hancock stands the most conspicuous figure of all the general officers who did not exercise a separate command." In 1885 he was chief commander at Grant's military funeral.

HAND, the part of the fore limb which is attached to the lower extremity of the fore-



HAND.

a, Bones; *b*, *c*, Muscles; *d*, *e*, hand of the Chimpanzee.

arm and is adapted for grasping. It is possessed by man, apes, monkeys, and lemurs, but in its highest perfection belongs only to man. The hand of apes and kindred animals serves partly for prehension and grasping, and to some extent it is necessary for support and locomotion. Twenty-seven bones comprise the framework of the human hand. In the wrist are eight separate bones, called the *carpal*, consisting of two rows, each containing four bones. The five bones of the inner hand and lower part of the thumb are called *metacarpal*, while in the fingers and thumb are fourteen bones, three in each finger and two in the thumb, these being known as the *phalanges*. The thumb, standing apart from the rest, possesses a well-known freedom of motion, and is thereby especially useful in seizing and grasping when brought in contact with the fingers. The outer phalanges form hinge joints, but the first bone of each finger is attached to the corresponding metacarpal bone so as to be movable in several directions. Fingers are named in order—the little, ring, middle, and index finger, and the thumb. When closed they fit the hollow of the hand, and are thus capable of more easily grasping objects of varying size. When clasping a ball, the tips of the fingers are in a straight line.

All parts of the hand are supplied with strong ligaments and muscles, thereby giving much freedom of motion, elasticity, and power of activity in numerous directions and for a great diversity of purposes. Artists have studied the elegance of outline, beauty of color, and delicacy of mold in the human hand, while its extraordinary mobility and adaptation to various uses have led many philosophers to attribute superiority to man fully as much on account of the hand as for his higher intellectual powers. The numerous nerves of the hand and fingers give the latter a more acute sense of touch than is found in any other part of the body. In linear measure the hand is assumed to be four inches and is frequently used in measuring the height of horses Palmistry relates to the lines of the inner hand. Those who make it a study claim to be able to predict regarding the future.

HANDEL (hăn'dĕl), **George Frederick**, musician and composer, born in Halle on the Saale, Germany, Feb. 23, 1685; died April 14, 1759. He was the son of a court surgeon in Brandenburg, who desired that the son should become a lawyer. However, his natural aptitude for music attracted the family and induced his father to arrange to give him a musical education. When seven years old he received instruction in Halle under Frederick Wilhelm Zachau and when nine years of age he was skilled in playing on the violin, organ, and a number of other instruments. In 1703 he went to Hamburg, where he played a violin in the operatic orchestra and soon after became a musical director. His first opera to be completed is "Almira," which appeared in 1705, and soon after he produced "Nero" and "Florinda." In 1707 he visited Italy, where he composed "Rodrigo." His "Agrippina" was played for thirteen nights in Venice. He returned to Germany in 1710 and while there was appointed chapel master to the elector of Hanover, afterward George I. of England, under whom he subsequently received preferment in London.

The Royal Academy of Music was founded in the Haymarket, in 1720, with the special view

of performing the operas of Handel under his personal direction. He remained seventeen years in London, producing many of his well known operas, but in 1737 his management and composing were interrupted by a severe impairment of his health. After receiving careful treatment, he partially recovered physical strength and again wrote numerous oratorios. In 1752 he lost his sight, but subsequently composed and played on various instruments. Among his most celebrated and best known productions, besides those already named, are "Atalanta," "Pastor Fido," "Israel in Egypt," "Alexander's Feast," "Sampson," "Ode for Saint Cecilia's Day," "Messiah," "Esther," "Deborah," and "Jephthah," the last of his oratorios. Handel had few equals as a musician and composer, his productions being characterized by great grandeur and sublimity. "Atalanta" is considered his greatest musical composition. It has hardly a parallel in musical history.

GEORGE F. HANDEL.

HANG-CHOW (häng'chou), a port and city in China, capital of the province of Che-kiang, on the Tsien-tang River, at the place where it flows into Hang-chow Bay. It is the southern terminus of the Grand Canal, which furnishes transportation facilities to Tientsin. Walls about twenty feet thick and from thirty to forty feet high surround the older parts, but the finest buildings are outside the walls, in the suburbs. The city has some of the most beautiful monuments, temples, and edifices of China. It ranks as one of the leading literary, religious, and commercial centers and is noted for its public improvements and well-paved streets. Among the manufactures are silks, tapestry, furs, lacquered ware, carpets, porcelain, jewelry, fans, and machinery. The foreign trade is transacted chiefly at Chapu, its seaport, about twenty miles nearer the sea. At the time of its greatest prosperity it had a population of over 2,000,000. The Taipang rebellion of 1861 caused temporary decline, but it is rapidly gaining in population and industrial rank. Marco Polo visited the city in the 13th century and described it as a center of much grandeur and wealth. In 1896 it was opened to foreign commerce. Population, 1922, 768,550.

HANGING, a mode of inflicting capital punishment. This method is of great antiquity and was first practiced by hanging a murderer upon a gibbet near the place where the crime was committed. It was first used in England in 1241, when the son of a nobleman was hanged for piracy. At present it is the ordinary mode of executing in the United States and Great Britain, but in a few of the states in the former country electrocution has been adopted. Hanging causes the windpipe to become compressed by the rope or cord, which prevents the flow of blood to a considerable extent and in some instances causes a fracture or dislocation of the vertabrae. Although attended by violent struggles in some cases, it is considered one of the most humane methods and is usually administered without unnecessary publicity. The courts that pronounce the sentence usually direct that the convict "be hanged by the neck until he is dead."

HANGING GARDENS, a structure built at Babylon and classed among the seven wonders of the world. The construction of these gardens is attributed to Nebuchadnezzar about five centuries B. C., although others ascribe them as the work of Queen Semiramis, fully seven centuries earlier. Several historians who attribute them to Nebuchadnezzar think they were built to gratify his Median queen, Amytis, for the purpose of making the plains of Babylonia less dreary to her when contrasted with the mountain scenery of her native land. The gardens covered an area of four acres, were supported on arches of masonry of terrace construction, and rose to a height of 75 feet. A reservoir at the top supplied water, which was pumped by a force of men from the Euphrates, to irrigate the flowers, shrubs, and trees by artificial channels and fountains. Banqueting rooms were maintained in various parts of the gardens, and beautiful scenic walks and resting places were located at convenient localities.

HANKOW (hän-kou'), a river port and city in China, at the junction of the Yang-tse-kiang and the Han River, in the province of Hupeh. The site is mainly in the angle formed by the two rivers, hence is quite level and not well drained. It is on the line of the trunk railway which is eventually to connect Canton on the south with Pekin on the north. Regular steamship communication is maintained with the leading ports of China. It is important as a commercial center and is the chief industrial city in the green tea district. The manufactures include porcelain, clothing, jewelry, earthenware, and silks. It was opened to foreign commerce in 1862. The trade is chiefly with Great Britain, Japan, and Germany. Population, 1922, 585,500.

HANLEY (hăn'lĭ), a manufacturing city of Staffordshire, England, near Stoke-upon-Trent, about 148 miles northwest of London. It is on a branch of the Trent and Mersey Canal and has extensive steam and electric railway connections. The municipality maintains a market, public baths, a cemetery, and a public library. Among the manufactures are chinaware, cloth-

ing, pottery, and machinery. Hanley was granted a municipal constitution in 1857. Population, 1922, 67,174.

HANNA (hăn'nà), **Marcus Alonzo,** capitalist and public man, born in Lisbon, Ohio, Sept. 24, 1837; died Feb. 15, 1904. After studying at the Western Reserve University, he entered the grocery business, and in 1867 became largely interested in the coal and iron industry. Being a man of sagacious business habits, his enterprises were highly profitable, yielding large returns, and he invested heavily in banking, railways, and shipbuilding. In 1896 he served as chairman of the Republican national committee, in which capacity all his excellent ability as an organizer was brought into play, thus giving that party the advantage of thorough organization. He was elected a United States Senator in 1897, in which capacity he was in close touch with the administration of President McKinley, and in 1900 again served as chairman in the presidential campaign. In 1903 he was reëlected to the Senate. He was closely identified with the movement in favor of a gold monetary standard and as an advocate of the ship subsidy bill.

HANNAY, James, historian and journalist, born at Richibucto, New Brunswick, April 22, 1842; died Jan. 12, 1910. He studied in Saint John and in 1867 was admitted to the bar. The same year he became official reporter of the supreme court of the province, serving until 1873, when he became editor of the Saint John *Daily Telegraph.* In 1883 he engaged on the editorial staff of the Montreal *Herald,* two years later became a writer for the Brooklyn *Eagle,* and in 1888 was made editor of the Saint John *Gazette.* His editorials exercised a wide influence upon the social and political life of Canada and he published many delightful stories and ballads. In 1901 he became official reporter of the provincial Parliament of New Brunswick. His books include "History of the War of 1812," "History of Acadia," "History of the Loyalists," "Life and Times of Sir Leonard Tilley," "History of New Brunswick," and "Story of the Queen's Rangers in the American Revolution."

HANNIBAL (hăn'nĭ-bal), or **Annibel,** Carthaginian general, son of Hamilcar Barca, born in 247 B. C.; died in Nicomedia, Bithynia, in 183. When only nine years of age he was taken by his father before an altar to swear eternal enmity against Rome, and immediately accompanied the army on the great campaigns led against Spain. After remaining nine years under the training of his father, he returned for a short time to Carthage, but rejoined the army in Spain at the age of 22 and served under his brother-in-law, Hasdrubal. At the death of the latter, in 221 B. C., Hannibal was elected to the chief command by acclamation, and at once prepared to pursue the course of his father in fighting against the Romans within their own territory. With an army of 90,000 infantry, 12,000 cavalry, and 40 elephants he started upon his famous march across the Pyrenees, the Rhone, and the Alps for the purpose of conquering Italy. It is thought that he crossed the Alps by the Little Saint Bernard pass. His force was greatly diminished by hardships during the passage, particularly after crossing the Pyrenees, where he was met near the Rhone by a powerful army of Gauls, but these he defeated. Upon reaching the southern side of the Alps, his army consisted of only 30,000 men, a force much inferior to the powerful body of trained soldiers at the disposal of Rome. Near the Ticino River he was met by Publius Scipio, who commanded a large Roman army, but with his superior Numidian cavalry he succeeded in defeating the Romans in 218 B. C., driving the forces across the Po, and again winning a victory at Trebia.

The next year Hannibal moved southward and defeated the Roman general Flaminius near Lake Trasumenus, taking 15,000 prisoners. Soon after he invaded Apulia, where he spread terror and by continued successes hastened the appointment of Fabius Maximus as Roman dictator. Fabius at once adopted the policy of harassing the enemy by cutting off its supplies, but skillfully avoiding a pitched battle. This course of warfare, though at first discouraging to his countrymen, was effective in causing the Carthaginian army to waste away by inactivity and disappointment. In the spring of 216 Hannibal posted his army, now largely increased, in the vicinity of Cannae, and was attacked by the Roman army under Terentius Varro and Aemilius Paulis. The Carthaginian army was drawn up in the shape of a half moon with the convex side toward the enemy, and at the horns of the crescent was his Numidian cavalry. As the legions of Rome advanced upon the center it skillfully retreated, but, when they pressed forward in eager pursuit, the Carthaginian horsemen fell upon the Romans from every side, rendering them unable to either fight or flee. About 60,000 Romans were slain in the fearful massacre, among them 21 tribunes and 80 senators. Hannibal sent a bushel of gold rings to Carthage after the battle, these having been the ornaments of Roman knights. Within eighteen months fully one-fifth of the citizens able to bear arms had fallen and all southern Italy and Capua were compelled to join Hannibal. The campaigns of the succeeding three years were unimportant, though in 212 Hannibal seized Tarentum, but two armies were sent from Rome against Capua. As a measure of relief to Capua, Hannibal conducted a powerful army to attack Rome in 211, but that city was retaken and the Carthaginians fell back to Bruttium, where they were constantly confronted by superior numbers until 203, when Scipio invaded Carthage and Hannibal was recalled to defend his own country.

After expelling the Carthaginians from Spain,

Scipio invaded Africa and defeated Hannibal at Zama in 202, thus ending the Second Punic War. Carthage was reduced and compelled to submit to the most humiliating conditions of peace, being prohibited from going to war without the permission of Rome. Subsequently Hannibal began the improvement of his capital and native country, reforming the administration and finance and encouraging commercial intercourse. This caused much jealousy among the Romans and Hannibal was compelled to flee to the court of Antiochus of Syria, where he undertook to assist the Syrians in a war against Rome, but his expedition dispatched to attack the Rhodians with a Syrian fleet met disaster. He next fled to Bithynia, where he took refuge with King Prusias and gained several victories for that sovereign in battles against Roman allies. Later the Roman senate demanded the surrender of Hannibal, and since Prusias was not able to protect him, he took poison to end his life. Viewed in the light of achievements under difficulties, Hannibal stands as the greatest military genius in the world.

HANNIBAL, a city of Missouri, in Marion County, on the Mississippi River, 112 miles northwest of Saint Louis. It is on the Wabash, the Kansas City Southern, the Chicago, Burlington and Quincy, and other railroads. The chief buildings include the public high school, the city hall, the Federal building, and a public library of 15,000 volumes. In the vicinity are deposits of coal and limestone. Among the manufactures are flour, lime, pottery, machinery, tobacco, utensils, and railway cars. The city has a large trade in produce, grain, and merchandise. It was settled in 1819 and incorporated in 1839. Population, 1920, 18,950.

HANOI (hä-noi'), a city of Annam, capital of French Indo-China, on the Sonkoi or Red River. It is situated in a beautiful region about 110 miles from the China Sea and has wide and well-built streets. The chief buildings include a large Buddhist temple, the palace, the citadel, and several Christian churches. It is lighted with gas and electricity, has a system of waterworks, and is the seat of a large trade, both domestic and foreign. The manufactures include embroidery, mats, leather, silk and cotton textiles, and fireworks. About one per cent. of the inhabitants are Europeans. Several French newspapers are published within the city and it is the seat of many European public and missionary schools. It has been a possession of France since 1882. Population, 1922, 110,508.

HANOVER (hăn'ō-vēr), or **Hannover,** a province of Prussia, in the northwestern part of the German Empire. It has an area of 14,869 square miles. The surface is an undulating plain, with alluvial flats and moors in the northern portion. It is well watered by the Weser, Elbe, and Ems rivers and their numerous tributaries. Nearly one-half of the province is arable and about one-seventh is covered with timber. Farming and stock raising are extensive industries, but it likewise has considerable interests in fruit culture and fishing. It is penetrated by many steam and electric railways and is noted for its production of beet sugar. The mines yield vast quantities of copper, iron, lead, asphaltum, coal, zinc, and silver. Among the chief manufactures are clothing, canned fish, paper, glass, linen, woolen, and cotton goods, sugar, machinery, and musical instruments.

Hanover is divided into the six administrative districts of Lüneburg, Hanover, Stade, Hildesheim, Aurich, and Osnabrück. These districts are divided for local government into 78 circles. It holds high rank in education, its system of schools culminating in the famous University of Göttingen. Hanover was formerly an independent kingdom, but, siding with Austria in 1866, it was annexed to Prussia in the same year. Hanover is the capital. The inhabitants are chiefly Protestants. Population, 1920, 2,942,546.

HANOVER, a city in Germany, capital of the province of Hanover, at the confluence of the Leine and Ihme rivers, 65 miles southeast of Bremen. It is noted for its beautiful streets, extensive railroad connections, and commercial importance. The chief buildings include the royal palace, the Church of Christ, the railway station, the townhall, and the Royal Theater of Hanover. Among the manufactures are machinery, chemicals, cotton and woolen goods, tobacco and cigars, musical instruments, porcelain, and toys. Gas and electric lights, stone pavements, electric street railways, and systems of waterworks and sewerage are among the improvements. It is first mentioned in history in 1163, joined the Hanseatic League in 1481, and became the capital of Hanover in 1486. Since 1866 it has belonged to Prussia. Population, 1905, 250,024; in 1920, 302,384.

HANOVER, a town of New Hampshire, in Grafton County, on the Connecticut River, 55 miles northwest of Concord. It is opposite Norwich, Vt., with which it is connected by a bridge. Hanover is noted as the seat of Dartmouth College (q. v.), which was established here in 1769, and is one of the important educational institutions of America. The town is a beautiful place, having an advantageous site, scenic gardens, and many fine churches and residence buildings. Population, 1920, 1,513.

HANOVER, a borough of Pennsylvania, in York County, forty miles northwest of Baltimore, Md., on the Pennsylvania and the Western Maryland railroads. It is surrounded by a productive agricultural region. Deposits of iron ore and clay are worked in the vicinity. The manufactures include shoes, cigars, butter, clothing, and machinery. It has a large trade in merchandise and farm products. The first settlement on its site was made in 1730. Population, 1900, 5,302; in 1920, 3,664.

HANSBOROUGH, Henry Clay, public man, born in Prairie du Rocher, Ill., Jan. 30,

1848. He attended the public schools of his native State and in 1867 removed to California, where he learned the trade of a printer. For some time he published a daily newspaper at San Jose and in 1869 became connected with the San Francisco *Chronicle*. For two years he published a paper at Baraboo, Wis., and removed to Devil's Lake in 1882, at which time the State of North Dakota had not been admitted. He engaged in journalism and served two terms as mayor of the city. In 1889-91 he served in Congress as a Republican. He was elected United States Senator in the latter year, and was re-elected several times consecutively, in 1897 and 1903. In 1909 he was succeeded as Senator by Martin N. Johnson (1850-1909).

HANSEATIC LEAGUE (hăn-sē-ăt'ĭk lēg'), or **Hansa,** an association of certain German and adjacent cities formed in the 13th century for the purpose of mutual protection and the development of commercial interests. The first steps in the direction were taken by Hamburg, Hadeln, and Ditmarsh in 1219 to protect themselves against pirates that infested the North Sea. In 1241 the city of Lübeck was added with the view of joining Hamburg in protecting travel on the highway across Holstein between the Baltic and the North Sea. Brunswick joined in 1247, when the general name applied to the league originated. During its most prosperous period the association included 85 cities, embracing both inland and maritime towns from Amsterdam to Reval, and from Cologne to Breslau and Cracow. Lübeck was recognized as the principal member and was the meeting place of the deputies who governed the league. The association attained much political influence by supplying money and extending trade to various countries.

The Hanseatic League, as a safeguard and for mutual protection, maintained armies and navies. It constructed canals, developed the principles of mercantile law, adopted a system of weights and measures, and made treaties with various countries to further commercial interests. In 1370 its army gained victories over the kings of Norway, Sweden, and Denmark, and for a time the association claimed the power to choose the sovereign of the last mentioned country. Since the seaport cities possessed advantages over inland towns, the league began to lose power in the 16th century, and most of the countries with which it had treaties revoked them before the beginning of the 17th century. After 1628 the only cities to maintain an organization were Hamburg, Lübeck, and Bremen, but these were joined by Frankfort-on-Main in 1813. In 1866 Frankfort was incorporated with Prussia and the other three became a part of the German Empire in 1870. Since 1889 these cities have belonged to the German customs union.

HANSEN (hän'sẹn), **Gerhard Henrik Armauer,** physician, born in Bergen, Norway, in 1841. He studied in his native city and took a medical course, and was made physician in the government hospital in Christiania. Subsequently he became medical officer at the Lofoten fisheries, was assistant at the Bergen Leper Hospital, and wrote various tracts and treatises relating to medical practice. His reputation is based largely upon the discovery of the bacillus of leprosy, which has aided materially in the treatment of the disease as well as enabled the medical profession to guard quite successfully against its spread by contagion. Several scientific associations bestowed marks of distinction upon him. He died Feb. 12, 1912.

HANSLICK (häns'lĭk), **Eduard,** musical author and critic, born in Prague, Hungary, in 1825. He studied law at Prague and Vienna and received an official appointment from the government, but later turned his attention to music. After studying several years at Prague, he became musical critic of the *Wiener Zeitung* and wrote musical reviews and other publications. In 1861 he was made professor of music in the Vienna University, where he served successfully more than forty years. Among his works are "The Modern Opera," "History of Concerts in Vienna," "Views from My Life," and "Concerts and Composers of the Last Fifteen Years." He died in 1904.

HAPSBURG, House of, the reigning dynasty of Austria. The name was derived from the castle of Hapsburg in the Swiss canton of Aargau, on the Aar River. Bishop Werner of Strassburg built the castle in 1027, and his successor, Werner II., was the first to assume the title of Count of Hapsburg, about 1090. From him descended Albert, who is mentioned as Count of Hapsburg in 1152, and Emperor Frederick I. appointed him landgrave of upper Alsace. The family attained to much power in Swabia under his son, Rudolph I., and in 1273 Rudolph, son of Albert IV., secured the election as Emperor of Germany. He became hereditary monarch of Austria in 1282. From him descended all the Hapsburg monarchs of Austria to Charles VI. With the marriage of Marie Theresa to Francis Stephen of Lorraine, it became known as the house of Hapsburg-Lorraine, and Francis II. assumed the title of Emperor of Austria. The house of Hapsburg has furnished numerous sovereigns of Austria, Germany, and Spain, Francis Joseph I. being one of its most distinguished members.

HARA-KIRI (hä'rä-kē'rĭ), or **Seppuku,** a method of committing suicide, formerly permitted by the government of Japan. It was practiced by those of the Samurai and nobles who preferred self-disembowelment to some disgrace. At first it took the form of a custom, but in 1500 it was adopted as a mode of punishment, and noblemen and gentlemen were permitted to demand the hara-kiri instead of being executed like common criminals. Afterward this mode of punishment developed into execution

by the best friend of the accused, who usually beheaded the criminal in the presence of friends and several official witnesses. Hara-kiri has been abolished as a mode of punishment, but suicide is sometimes committed by this method.

HARBOR (här'bẽr), a port for ships, natural or artificial, on the coast of a sea, lake, or some other body of water. The importance of a harbor depends upon the depth of its water, freedom from breakers, and natural protection against storms. Inlets and indentations on the shore of lakes and the ocean ordinarily furnish the best roadsteads for ships. Many governments have made liberal expenditures to dredge and otherwise improve the harbors located on rivers, lakes, and the ocean. Indeed, the designing and construction of harbors constitute one of the most difficult departments of civil engineering. Among the essential parts of harbors are docks, quays, piers, jetties, wharves, and breakwaters. A harbor which is designed primarily for shelter, usually called a *harbor of refuge,* must have an artificial or a natural breakwater. Commodious docks are maintained in many harbors, whereby loading and unloading is facilitated by keeping the water surface practically at a common level.

HARBOR GRACE, a port of Newfoundland, on the west coast of Conception Bay, 27 miles northwest of Saint John's. It is connected with the interior by the Newfoundland Railway. The chief buildings include the cathedral, the public library, and the courthouse. The harbor is well protected by the beach. It has many mercantile establishments, fishery supply houses, and manufactures of clothing, earthenware, and machinery. The place is noted for its fine scenery, well graded streets, and extensive facilities for bathing and boating. It has an important commercial trade, both inland and foreign. Population, 1901, 5,184; in 1921, 6,567.

HARBURG (här'bo͝org), a city of Germany, in the province of Hanover, on the Elbe River. It has extensive railroad and electric railway facilities and a large trade in farm produce and merchandise. An old castle on the Elbe, a real gymnasium, and several schools and churches are among the noteworthy buildings. The manufactures include chemicals, jute, linseed oil, cement, boilers, glass, machinery, and gutta-percha wares. An electric railway connects it with Hamburg, which is seven miles north. It has been a part of Prussia since 1866. Population, 1905, 55,676; in 1920, 67,024.

HARCOURT (här'kŭrt), **Richard,** public man, born in Toronto, Canada, March 17, 1849. He studied at the University of Toronto and was admitted to the bar in 1876. After practicing his profession for two years, he was elected a member of the Assembly of Ontario, and in 1888 became a member of the Cabinet. He was treasurer of the Province from 1888 to 1898 and served a term of years as minister of education.

HARCOURT. Sir William George Granville Vernon, statesman, born in Oxford, England, Oct. 14, 1827; died Oct. 1, 1904. He was appointed professor of international law at Cambridge in 1869, but resigned in 1873 to become Solicitor-General in the Gladstone administration and was knighted.

HARDECANUTE (här-dē-kȧ-nūt'). **See Canute.**

HARDEE (här'dē), **William Joseph,** soldier, born in Savannah, Ga., Oct. 10, 1815; died in Wytheville, Va., Nov. 6, 1873. He joined the Confederate army with the rank of colonel, and took part in the battles of Shiloh, Murfreesboro, Chattanooga, Savannah, and Charleston. His distinguished service won promotion to the rank of lieutenant general. He is author of Hardee's "Tactics," a work adopted for use in the army and militia of the United States.

HARDENBERG (här'dẹn-bẽrg), **Karl August,** statesman, born at Essenrode, Germany, May 31, 1750; died Nov. 26, 1822. He studied at Leipzig and Göttingen and entered the public service under the King of Hanover. In 1787 he was made president of the council of state in Brunswick and soon after became minister of state in Prussia. In 1814 he signed the Treaty of Paris, and the following year took part in the congress at Vienna. To him Prussia is indebted for many civil and educational reforms.

HARDING, Warren Gamaliel, twenty-eighth President of the United, States, born at Corsica, Ohio, Nov. 2, 1865; died Aug. 2, 1923. His father, George T. Harding, was a practicing physician. The son worked on the farm and attended the public schools until 1880, when he entered Ohio Central College at Iberia, where he edited the college paper. In 1883 he began work in a printing office and the following year acquired control of the *Marion Star* at Marion, Ohio, where he resided permanently and married Florence Kling in 1891; the union remained childless. He was State Senator two terms, being elected in 1899 and 1903, and the following year became Lieutenant-Governor. In 1912 he was a candidate for Governor, but was defeated by his Democratic opponent, Governor Harmon. In 1920 he was elected President by the largest popular vote ever polled in the country, defeating his Democratic opponent, Governor James M. Cox. He surrounded himself with an able cabinet and adopted a progressive policy tempered with conservatism. Among the events of his administration are the reconstruction period following the Great War, the discussion of Ship Subsidy, the enlargement of foreign commerce, and the movement for a World Court. His death resulted from apoplexy at San Francisco, while returning from a trip to Alaska.

HARDNESS (härd'nĕs), the property of matter which causes bodies to resist being scratched or worn by other bodies. Since there is no such thing as an absolutely hard or soft

body, it follows that hardness is a relative property. Heating and cooling change the degree of hardness of some metals. If iron and steel are heated and then cooled slowly, they become softer, but they are hardened by being cooled quickly after raising the temperature to a red heat. On the other hand, copper is softened by cooling quickly and hardened by cooling slowly. The diamond is the hardest of all natural substances and diamond dust is used to cut other stones. Glass, which is harder than wax, is softer than the diamond. Both glass and steel are hard, but the former is brittle while the latter is tough.

HARDY (här'dĭ), **Thomas,** novelist, born at Dorsetshire, England, June 2, 1840; died Jan. 11, 1928. He studied at King's College, London, and worked as architect from 1862 until 1867. In the latter year he turned his attention to literature and took up his residence near Dorsetshire in his native county. His first novel was published in 1871 under the title "Desperate Remedies," which was soon followed by others of considerable interest, most of which are largely tales of rustic life. In 1901 he published "Poems of the Past and Present," which contains many of his poetical productions gathered from his writings covering a period of about thirty years. Other works include "Under the Greenwood Tree," "Three Wayfarers," "Far from the Madding Crowd," "The Return of the Native," "A Pair of Blue Eyes," "Life's Little Ironies," "A Pure Woman Faithfully Presented," and "Jude, the Obscure."

HARE, a class of rodent quadrupeds which belong to the genus *Lepus.* They are characterized by a short tail, long ears, a cleft upper lip,

HARE.

and long hind legs. Hares are similar to rabbits in all general respects, but differ from them in that the latter are inclined to burrow more extensively and show more sociability in living in families, while hares are solitary and prefer to find an abode in grasses and underbrush. About forty species have been described, fully half of which are indigenous to America. The *polar hares* of North America are noted for their pure white color in winter and large size, while the *prairie hares,* a class embracing the *jack rabbits,* are distinguished for their large body and long limbs. The timidity of these animals is proverbial, though their lack of courage and cunning is overcome largely by marked acuteness of hearing and sight and by their remarkable swiftness in leaping and running. Most species lie secluded during the day and come out at twilight in search of food, which consists mainly of green vegetation, roots, and the bark of trees, but in populated districts they feed also on cereals. The voice somewhat resembles that of a child, but it is never heard except when they are wounded or seized. The flesh is prized as an article of food, but it is much more valuable during the fall and winter than in the summer season. It is rare sport to pursue the hare, especially after a light fall of snow, when it may be tracked to its place of hiding. The fur of hares enters into the manufacture of hats, and is used to a limited extent for linings and garments.

HAREBELL (hâr'bĕl), or **Bluebell,** the name of a plant native to Europe and America, so named from its bell-shaped flower. The stem is slender and about five inches high and the flowers are variously colored. Most of the species have blue flowers, hence they are called *bluebells* in some localities. The harebell thrives in cold regions and the flowers are often seen among the snow and ice on the rocky slopes of mountains. It is believed they generate sufficient heat to permit their growth and endurance under such conditions.

HAREM (hā'rĕm), the set of apartments reserved for the female members of a Mohammedan family, at which all males are forbidden entrance, except the husband and near relatives. Harems are maintained only by the richer Moslems and in them the wives, concubines, and children have their abode, being attended by female slaves and eunuchs. The inmates spend their lives largely in dressing, bathing, pleasurable occupations, and in the society of other Turkish women. It is commonly reported that the Sultan of Turkey maintains the greatest harem in the world, most of his women being Circassians and Georgians. The apartments occupied by them are of magnificent architecture and contain elaborate decorations and furniture. At the time of the Spanish-American War much interest centered in the Sultan of the Sulu Islands, one of the Philippines, who maintained a harem of considerable size.

HARGREAVES (här'grāvz), **James,** inventor, born near Blackburn, England, in 1720; died April 22, 1778. He invented the carding machine in 1760, an apparatus that superseded hand cards, and a few years later constructed the spinning jenny, which enabled him to spin successfully with several spindles at a time. The

large amount of yarn produced in his dwelling caused workmen to suspect his invention and accordingly they forced an entrance and destroyed the machine, causing Hargreaves to remove to Nottingham. A patent was issued to him in 1770, but it was afterward held invalid because he had sold several machines before obtaining it. However, he became an extensive manufacturer, and a moderate reward was granted his family by the government for the benefit his invention proved to the country.

HARKAVY (här'kȧ-vĭ), **Avraam,** orientalist, born in Novogrudok, Lithuania, in 1839. He studied at Saint Petersburg, Russia, and Berlin, Germany, and was librarian of the imperial public library of Saint Petersburg a number of years. His writings are devoted largely to Semitic history and literature, but he also gave much attention in writing to Russian and Indo-European peoples. He edited "A History of the Jews" and contributed to Gustav Karpele's "History of Jewish Literature." His publications include "Studies of the Public Library of Saint Petersburg," "Report of the Archaeological Congress," and "The Jewish Monuments of the Crimea."

HARKNESS (härk'nĕs), **Albert,** educator, born in Mendon, Mass., Oct. 6, 1822; died May 27, 1907. In 1842 he graduated at Brown University and taught one year in the high school at Providence, after which he spent two years at the universities of Berlin and Bonn. The latter gave him a degree in 1854, the first to be awarded by that institution to an American, and the following year he became professor of Greek in Brown University. He made a number of visits to Europe to study methods of instruction used by the universities, was one of the founders of the American Philographical Association, and contributed to education by publishing many popular text-books. His chief writings are "First Latin Book," "Second Latin Book and Reader," "Latin Composition," "Complete Latin Course for the First Year," and "Complete Latin Grammar."

HARLAN (här'lȧn), **James,** statesman, born in Clark County, Illinois, Feb. 25, 1820; died in Mount Pleasant, Iowa, Oct. 5, 1899. He graduated at Indiana Asbury College in 1845, two years later became superintendent of public instruction for Iowa, and in 1853 was made president of the Iowa Wesleyan University. In 1855 he was elected to the United States Senate and was reëlected in 1861 and again in 1866. President Lincoln appointed him Secretary of the Interior in 1865, but he resigned this position when elected to the Senate in 1866. In 1869 he was elected president of the Iowa University, where he rendered efficient service.

HARLAN, John Marshall, jurist, born in Boyle County, Kentucky, June 1, 1833. He graduated at Central College in 1850, was admitted to the bar in 1853, and served as colonel in the Union army from 1861 until 1863, when he became attorney-general for his State. President Hayes appointed him associate justice of the United States Supreme Court in 1877, by virtue of which position he was a member of the commission to settle the Bering Sea dispute in 1892. He was one of the four judges who upheld the validity of the income tax, in 1894, when the constitutionality of the Wilson Tariff Law was questioned. He died Oct. 14, 1911.

HARLAND, Henry, novelist, born at Saint Petersburg, Russia, in 1861; died in 1905. He studied at the College of the City of New York and at Harvard, and for some time traveled in Europe as a correspondent of American newspapers. He held an official position in the city of New York a number of years and afterward removed to London, where he became known extensively under the pseudonym of Sidney Luska. Besides editing the *Yellow Book,* he published a number of popular works. Among his writings are "Grey Roses," "Comedies and Errors," "The Lady Paramount," "The Cardinal's Snuff-box," "Mr. Sonnenschein's Inheritance," and "My Friend Prospero."

HARLEM RIVER (här'lĕm), the name given to the tide channel that separates Manhattan Island, on which New York City is mainly situated, from the mainland. It connects the Hudson River with the channel called East River, which separates Manhattan from Long Island. Harlem River begins at Kingsbridge, where Tibbet's Brook flows into Spuyten Duyvil Creek, and extends for a distance of seven miles toward the southeast to Randall's Island, near Hell Gate. At low water the depth is nine feet and at high water fifteen feet. The Speedway, a beautiful roadway, extends along the western shore of the Harlem and the buildings of New York University are on the lofty eminence on the opposite shore.

HARLEY (här'lĭ), **Robert,** statesman, born in London, England, Dec. 5, 1661; died May 21, 1724. He descended from a celebrated Herefordshire family and at an early age was elected to Parliament as a Whig, but later became a leader of the Tory party. In 1710 he caused the dismissal of Godolphin and was himself appointed Chancellor of the Exchequer. During his incumbency in this office he became highly popular, but when George I. ascended the throne he was impeached for alleged intrigues with the Jacobites. He remained in prison for two years and was finally acquitted.

HARMON, Judson, public man, born at Newtown, Ohio, Feb. 3, 1846. He studied at Cincinnati and began the study of law in that city. President Cleveland made him attorney-general in 1895. He was elected governor of Ohio in 1909 and was reëlected in 1911. In 1912 he was a candidate for President.

HARMAR (här'mär), **Josiah,** soldier, born in Philadelphia, Pa., in 1753; died there Aug. 20, 1813. He was brought up as a Quaker, served as lieutenant colonel in the Revolutionary

army from 1776 until 1782, and was brevetted colonel the following year. In 1783 he carried the ratification of the final treaty with England to France, by which American independence was established. In 1789 he was made general in chief of the United States army, and distinguished himself in an expedition against the Miami Indians.

HARMONICA (här-mŏn'ĭ-kà), an instrument for producing musical sounds by means of glasses of different sizes. The glasses are fixed to a spindle, which is set in motion by a treadle worked with the foot, and they are touched by the moistened finger of the player as they revolve. This instrument was improved by Benjamin Franklin, who invented the revolving spindle, and in this form the instrument became fashionable in America and England. Miss Davis, a relative of Franklin, became celebrated as a player on the harmonica. However, the instrument was known at the time Goldsmith mentioned the musical glasses in his novel. The name harmonica is applied to a flat instrument with delicate brass reeds, which is played by the inhalation or exhalation of the breath, and is sometimes called *mouth organ.*

HARMONICS (här-mŏn'iks), in music, the attendant or secondary tones produced by the vibration in aliquot parts of the same body or string that gives, by its complete simultaneous vibration, the primary or fundamental tones. They are sometimes called *overtones.* The vibration of a piano is so regulated that higher harmonics than the seven are not present. Harmonics serve to modify tones and give them their distinctive quality or timbre, and may be detected without difficulty by the practiced ear.

HARMONY OF THE SPHERES, a kind of music supposed by the ancients to be produced by the motion of the heavenly bodies. Pythagoras and a number of early philosophers taught that the harmony of the spheres is audible at all times, but that it cannot be contrasted with absolute silence, since the latter is a condition entirely unknown. It was the general impression that this music was produced under fixed laws, which could be expressed in numbers like those used in designating the harmony of sounds.

HARMSWORTH, Alfred Charles, journalist, born near Dublin, Ireland, in 1865. He was educated by private tutors and at the Stamford Grammar School and took up journalism. In 1882 he joined the staff of the *Illustrated London News* and in 1894 became editor and proprietor of the London *Evening Journal.* He founded the *Daily Mail* in 1896. About this time he became interested in the Jackson-Harmsworth Arctic expedition, which he organized and promoted. In 1900 he visited the United States and Canada, where he studied the theory of publishing and illustrating newspapers as practiced in these countries.

HARNACK (här'nàk), **Adolf,** theologian, born at Dorpat, Russia, May 7, 1851. He studied at the university in his native town, became docent in the University of Leipzig in 1874, and was teacher at various institutions until 1889, when he was chosen professor of church history at the University of Berlin. As a critic of early church history he ranks foremost among writers and teachers, and his activity was as great as his work is inspiring. His father, Theodosius Harnack (d. 1889), was distinguished as a Lutheran theologian, to whom he owed much for his enthusiasm and acquired ability. His chief publications are "Texts and Researches in the History of Early Christian Literature," "Apostolic Faith-Knowledge," "Text-Book on the History of Dogma," "Introduction to Saint Augustine's Confession," "Lexicon of Dogmatic History," "Christianity and History," "The Influence of Christianity," and "The Influence of Martin Luther upon the History of Knowledge and Civilization." He joined E. Shürer in editing the *Journal of Theological Literature.*

HARNESS, the equipment of a horse for drawing a coach, wagon, or a vehicle or load of any kind. It consists essentially of leather straps, either simple or padded, fastened or united by sewing, buckles, or rings. Formerly harnesses were either sewed or riveted by hand, but at present they are made almost entirely by sewing machines. The principal parts of a harness consist of the saddle, collar, tugs, bridle, checkrein, hames, and lines. Harnesses intended for heavy work are usually plain and strong, while those for light driving are mounted or ornamented with silver or gold plate.

HAROLD (hăr'ŭld), the name of four kings of Norway, who reigned between 863 and 1136, and of whom Harold III. is the most noted. He was the son of Jarl Sigurd, by whom he descended from Harold I. At an early age he joined the Varangian guard at Constantinople, took a prominent part against the African pirates in Sicily and Italy, and was appointed commander of the bodyguard which defeated the Saracens. In 1042 he returned to Norway, three years later came to an understanding with his relative Swend of Denmark, and in 1047 succeeded Magnus the Good as king. In 1066 he sailed for England with an immense fleet for the purpose of assisting Tostig, brother of Harold II., King of England, in an invasion of that country, but at the Battle of Stamford Bridge the allied army and navy were defeated and both he and Tostig were slain.

HAROLD, the name of two Danish kings of England, who reigned between 1035 and 1066. Harold I., surnamed Harefoot, succeeded his father in 1035 as sovereign of the provinces north of the Thames, and in the same year became King of England, being elected to succeed Canute. He died in Oxford, March 17, 1040. Harold II. was the son of the Earl of Godwin and his Danish wife, Gytha, and in 1053 succeeded his father as Earl of the West Saxons.

After the death of King Edward, in 1066, Harold was crowned, and immediately organized offensive and defensive forces to repel the invasions of Tostig and Harold III. of Norway, the latter claiming the throne of England on account of Harold II. having descended from the Danish in the female line. A fierce and bloody struggle ensued at Stamford Bridge on Sept. 25, in which Tostig and Harold III. were killed. Three days later the Duke of Normandy landed at Bulverhithe and on Oct. 14 defeated Harold II. in the Battle of Hastings, in which the latter was slain. Harold fought heroically for the crown of England. He is made the subject of a drama by Tennyson and of a novel by Bulwer-Lytton.

HAROUN-AL-RASCHID (hȧ-rōōn'ăl-răsh'ĭd), famous caliph of the Saracens, born in Rei, March 20, 763 A. D.; died in Tus in March, 809. He ascended the throne of Bagdad when 22 years of age and at once became famous for the hospitality and benevolence of his court. His scholarship and ability as a poet made Bagdad the center of Moslem learning and art. However, the latter part of his reign was characterized by cruelty and oppression. In 803 he caused four of his sons, who had been intrusted largely with the government, and several other relatives and officials to be put to death. His death occurred while attempting to suppress a rebellion that had become widespread in his kingdom. He became known in history as Haroun the Magnificent and his fame is evinced by the Arabian Nights' Entertainments, though these attribute too much goodness to him.

HARP, a stringed instrument of triangular form. It is of great antiquity. The sculptures and ruins of the Egyptians and Syrians give evidence that it was a favorite instrument among them. It is mentioned at numerous places in the Scriptures, and long remained in popular favor among the Greeks, Romans, and various peoples of Western Europe. The instruments of this class used in ancient times were about seven feet high, and, like those of more modern manufacture, were furnished with gut strings. The harp mentioned in the Bible was somewhat smaller and could be carried easily from place to place by strolling musicians. In Western Europe the harps were similar to those of Eastern peoples, and formed a popular musical accessory for many centuries. The *Italian harp,* a kind popular in Italy several centuries ago, is rarely used at present, and the triangular harp of mediaeval construction has likewise gone out of general use. The so-called *pedal harp,* in which pedals are utilized to raise the pitch of all the strings chromatically, is the one now generally preferred. A harp on this plan was patented in 1810. It is provided with seven pedals, contains 43 strings tuned according to the diatonic scale, and may be readily adjusted to produce beautiful and diversified tones.

ANCIENT EGYPTIAN HARPS.

HARPER (här'pĕr), **William Rainey,** educator, born in New Concord, Ohio, July 26, 1856; died Jan. 10, 1906. He was educated at the Presbyterian college of his native town, studied at Yale University, and in 1879 became professor of Semitic languages in the Baptist Union Seminary near Chicago. From 1886 to 1891 he was professor of Semitic languages in Yale, and in the latter year was chosen president of the University of Chicago, with the professorship of Semitic literature. Dr. Harper secured several million dollars as endowments for that institution, established a high reputation by his discriminating and tireless efforts, and added a splendid system of postgraduate work. He attained to a wide reputation as Chautauquan lecturer and is the author of several important publications. His writings include several text-books which are used extensively in higher work. Among his books are "Elements of Hebrew," "Hebrew Method and Manual," and "Hebrew Vocabularies." He edited the "Old and New Testament Student" and "Hebraica."

WILLIAM RAINEY HARPER.

HARPER'S FERRY, a town of Jefferson County, West Virginia, at the confluence of the Potomac and Shenandoah rivers, 55 miles northwest of Washington. It is on the Baltimore and Ohio Railroad. The surrounding country is fertile, producing cereals, fruit, and vegetables. It is the seat of Storer College, a normal school for Negroes. Harper's Ferry is celebrated on account of the historic raid made by John Brown in 1859 for the purpose of forcibly liberating the slaves. When Virginia seceded, in 1861, it was abandoned by the Union garrison, consisting of only 45 men. The following year it was again occupied by the Federals, but General Jackson captured it on Sept. 15, 1862, and procured about 12,500 prisoners. Population, 1900, 896; in 1910, 766.

HARPIES (här'pĭz), in Greek mythology,

three female divinities called Aëllo, Ocypete, and Celaeno, who were employed by the gods for the punishment of the guilty. The poems of Homer mention them as storms and ascribe to them a flight more rapid than that of birds, or even the winds. In statuary they are represented with the head of a fair-haired lady and the body of a vulture, and appear to be affected by insatiable hunger, which caused them to rob their victims of food and otherwise afflict them.

HARPIGNIES (ăr-pē-nyĕ'), **Henri Joseph,** landscape painter, born in Valenciennes, France, July 28, 1819. He studied painting at Paris under J. Achard and in 1853 exhibited landscape paintings at the Salon. Several awards were granted him, among them a medal at the Paris Exposition of 1878, and in 1883 he was made an officer of the Legion of Honor. His paintings in water color are excellent and are distinguished because of superb drawing and fine composition. "The Edge of the Wood on the Banks of the Allier" was the first of his many productions to attract general attention. Other paintings include "The Banks of the Rhone," "Evening in the Campagna," "Garden of the Villa Medici," "Valley of Aumonce," and "Banks of the Sarthe." He died Aug. 28, 1916.

HARPOON (hăr-pōōn'), an implement of iron used in killing large fish and whales. It consists of a shank terminating at one end in a socket, to which a long rope is attached, and at the other end is a broad flat head, sharpened so as to penetrate with facility. It is furnished with barbs or withers. The rope, called the *whale line,* is coiled in the boat and is quite long, so the whale may dive after the harpoon, which is about three feet long, has been fastened into its body. Whalers may throw the harpoon by hand, or it may be shot from a harpoon gun. More recently the bomb lance has come into use. It is shot from a gun and explodes when the body of the whale is entered, causing almost instant death.

HARPSICHORD (härp'sĭ-kôrd), a stringed instrument with a keyboard somewhat resembling a modern pianoforte, and now largely superseded by it. A superior kind of harpsichord had two keyboards, one for producing the soft notes and the other the louder tones. They contained stops for modifying the tones, being thereby rendered suitable for different classes of music. The sounds were produced by the keys raising oblong slips of wood, called *jacks,* which were supplied with appendages that struck the wires in a manner quite similar to the hammers used in the modern pianoforte.

HARPY (här'pĭ), a large eagle of South America, considered one of the most powerful birds of prey. The bill is strong and curved at the tip, the toes have powerful claws, and the spread of wings is from five to six feet. The feathers of the breast are long and loose and the general color is black above and white below. The Indians use its feathers in making arrows and for decorative purposes. It lives in the dark forests, especially near the border of great rivers, and subsists on large birds, sloths, monkeys, young deer, and other quadrupeds. Naturalists agree that it is one of the most powerful and bold birds of prey, but the current idea that it attacks man is not well founded. The harpy is most numerous in South America, but is met with in various parts of Central America and Mexico.

HARRADEN (hăr'rà-dęn), **Beatrice,** novelist, born at Hampstead, England, Jan. 24, 1864. She studied at the University of Dresden, Germany, and subsequently at the University of London. In 1894 she traveled in the United States and Canada and for several months lived on a ranch in California. Her first novel was published in 1893, entitled "Ships that Pass in the Night." This work proved very popular and had a wide sale. Other writings include "Things Will Take a Turn," "In Varying Moods," "Hilda Strafford," "The Fowler," "The Scholar's Daughter," and "Untold Tales of the Past."

HARRIMAN, Edward Henry, capitalist, born at Hempstead, Long Island, Feb. 25, 1848. His father, Orlando Harriman, was a rector of the Protestant Episcopal church. The son attended Trinity School in New York City, where he afterward became a clerk in a broker's office in Wall Street. He organized the firm of E. H. Harriman & Co. in 1870 to engage in the stock brokerage business. His success enabled him to obtain a directorship of the Illinois Central in 1883. He was made vice president of the same railway in 1886 and soon after became its president. He was a member of the syndicate that bought the Union Pacific in 1898, which he helped to make a profitable property, and in 1901 he secured control of the Southern Pacific. In the same year he caused a panic by cornering the stock of the Northern Pacific, which he did to prevent James J. Hill from getting control of the Chicago, Burlington and Quincy Railway. He secured interests in a large number of railroads with remarkable rapidity, including the New York Central, the Atchison, Topeka and Santa Fé, the Chicago and Northwestern, the Chicago, Milwaukee and Saint Paul, the Central of Georgia, the Baltimore and Ohio, and other important lines. In 1909 the mileage of the Harriman roads was estimated at 67,759 miles. Perhaps, the business success of Harriman is not surpassed in the history of the country. He died Sept. 9, 1909.

HARRIS, Joel Chandler, author, born at Eatonton, Ga., Dec. 8, 1848; died July 3, 1908. He learned the trade of a printer, studied law, did editorial work, and practiced law at Forsythe, Ga. In 1876 he joined the staff of the Atlanta *Constitution,* of which he became editor in 1890, succeeding George W. Grady. In 1880 he published a collection of folklore entitled "Uncle Remus, His Songs and His Sayings,"

which deals in an interesting way with the American Negro and portrays the humorous side in a pleasing dialect. Other works of merit include "Nights with Uncle Remus," "Balaam and His Master," "Mingo, and Other Sketches," "Aaron in the Wildwoods," "Little Mr. Thimblefinger," "Tales of the Homefolks in Peace and War," "On the Wings of Occasion," and "Told by Uncle Remus."

HARRIS, Robert, painter, born in Carnarvonshire, Wales, in 1849. He was brought to Charlottetown, Prince of Wales Island, by his parents at an early age and attended Prince of Wales College in that city. He began to paint in early youth and in 1877 went to Europe to study, attending the Slade School in London. Later he studied in Paris and Italy and after a few years settled in Montreal. In 1883 he was made director of an art school in Montreal and ten years later became president of the Royal Academy of Canada, in which he rendered valuable service a long term of years. A number of his pictures were exhibited in the expositions of Paris, Chicago, Buffalo, and Saint Louis. They include many portraits and pictures of scenes in Canadian life. He died in 1919.

HARRIS, William Torrey, educator, born in Killingly, Conn., Sept. 10, 1835. He graduated at Phillips Andover Academy and Yale,

WILLIAM T. HARRIS.

served at superintendent of public schools at Saint Louis in 1868-80, and in the latter year represented the United States at the Brussels congress of educators. Subsequently he held many positions of honor. In the meantime he founded and for many years was editor of the *Journal of Speculative Philosophy,* the first publication of the kind in the English language. President Harrison appointed him commissioner of education, in which position he continued during the incumbency of President Cleveland and President McKinley. In 1906 he was succeeded in the office by Elmer E. Brown. He attained to high rank as a lecturer and writer on educational subjects. Besides publishing numerous works and reports on educational topics, he edited an international educational series of books. He died Nov. 5, 1909.

HARRISBURG (hăr'rĭs-bûrg), the capital of Pennsylvania, county seat of Dauphin County, on the Susquehanna River, 104 miles west of Philadelphia. It is on the Pennsylvania, the Philadelphia and Reading, the Cumberland Valley, and other railroads, and has communication by suburban and interurban electric railways. The site is a beautiful tract along the river, which is spanned by many bridges. It has broad and regularly platted streets and many fine public buildings, among them the State capitol, an arsenal, an insane asylum, a Roman Catholic cathedral, a State library of 105,000 volumes, and numerous beautiful churches. The State capitol, erected at a cost of $13,000,000, has a frontage of 520 feet and a dome 241 feet high. It was dedicated to public use in 1906, when President Roosevelt delivered the dedicatory address before a large concourse of people. Other noteworthy buildings include the Penn High School, the county courthouse, the Federal building, the Chamber of Commerce, the Y .M. C. A. building, and many tall bank and office buildings.

The importance of Harrisburg as a manufacturing center is to be attributed to large deposits of coal in the vicinity, and to its excellent transportation facilities by river navigation and railways. Among the manufactures are railroad engines and cars, hats, ironware, machinery, cotton and woolen goods, flour, shoes, pottery, silk textiles, musical instruments, and brooms. The extensive iron and steel interests are worthy of special mention. It has a large trade in grain, lumber, coal, building stone, and merchandise. The streets are well graded and paved with stone and asphalt. Harrisburg was first settled in 1726 by John Harris, an English trader. It was platted in 1785, became the capital in 1812, and was chartered as a city in 1860. Population, 1900, 50,167; in 1920, 75,917.

HARRISON (hăr'rĭ-sŭn), a city of Hudson County, New Jersey, on the Passaic River, opposite the city of Newark. It is on the Erie, the Pennsylvania, and the Lackawanna railroads. The surrounding country is agricultural and fruit growing. Among the manufactures are cutlery, linoleum, thread, electric fixtures, wire, machinery, and clothing. It is the seat of the State Soldiers' Home, has communication by electric railways and maintains a system of waterworks. Harrison was settled in 1668 and incorporated in 1873. Population, 1920, 15,721.

HARRISON, Benjamin, statesman, born in Berkeley, Va., about 1740; died in 1791. He was elected a member of the Virginia House of Burgesses in 1764, where he became one of the leaders, but opposed the resolutions offered by Patrick Henry against the Stamp Act. However, he was elected to the First Continental Congress as a delegate from Virginia and was a supporter and signer of the Declaration of Independence. In 1777 he was again elected to the House of Burgesses in Virginia, of which he was speaker for five years, and subsequently served three years as Governor. He retired to private life in 1785, but was a member of the State convention which ratified the Federal Constitution in 1788.

HARRISON, Benjamin, twenty-third President of the United States, born in North Bend, Ohio, Aug. 20, 1833; died March 13, 1901. His father, John Scott Harrison, was the third son

of General Harrison, ninth President of the United States, who was the third son of Benjamin Harrison (q. v.), a signer of the Declaration of Independence. He attended school at College Hill, near Cincinnati, and in 1852 graduated at Miami University, in Oxford, Ohio. In 1853 he married Caroline Scott, studied law in Cincinnati, was admitted to the bar in 1854, and entered upon the practice of law in Indianapolis, Ind., where he continued to reside. His first appointment was that of a crier in the Federal Court at a salary of $2.50 per day, and his earliest case at law was an action brought for burglary by Jonathan W. Gordon, which he won by making an eloquent plea.

BENJAMIN HARRISON.

He was elected as a Republican to the office of supreme court reporter of Indiana in 1860, but joined the army soon after the Civil War broke out, and in 1864 was again chosen State supreme court reporter by a large majority, though he did not resume his work in that position until after the war closed. He was made colonel in 1862 and led the 70th Indiana volunteers into the field, and was ordered to Bowling Green, Ky. His services in the army were distinguished at Resaca, Kenesaw Mountain, Peachtree Creek, and while with Sherman in the Atlanta campaign. When Atlanta was taken by Sherman in 1864, Colonel Harrison received his first furlough to visit home. Subsequently he took part in the Battle of Nashville and was commissioned brevet brigadier general in 1865.

After the war Harrison returned to Indianapolis, resumed his office of reporter of the supreme court, and in 1867 devoted his attention to the practice of law. In the presidential campaigns of 1868 and 1872 he made vigorous canvasses in favor of General Grant, and in 1876 was defeated for Governor, but ran fully 2,000 votes ahead of his associates. In 1879 he served as a member of the Mississippi River commission, supported James A. Garfield for President in 1880, and refused a cabinet position offered him. In 1881-87 he served as a member of the United States Senate and there advocated civil service reform and the reconstruction of the navy. The republicans nominated him for President in 1888 and he received 233 of the electoral votes, 168 being cast for President Cleveland. In 1892 he was again nominated for President, but was defeated, receiving 145 electoral votes, while 276 were cast for Grover Cleveland.

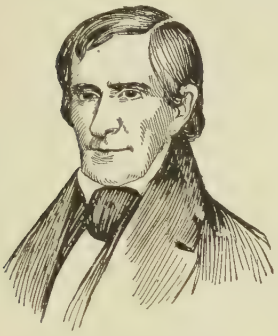
The principal events of his administration include the Pan-American Congress at Washington, which was held for the promotion of commercial relations between the North and South American republics. Other prominent events include the Bering Sea fishery dispute with Great Britain, the suppression of the Louisiana Lottery, the adoption of the McKinley tariff bill, the establishment of Blaine's reciprocity policy, and the settlement of Chilean and Samoan difficulties. After retiring from the Presidency, he resumed his law practice at Indianapolis and wrote and lectured extensively on jurisprudence. He published "This Country of Ours" and "Views of an Ex-President."

HARRISON, Carter Henry, public man, born in Chicago, Ill., April 23, 1860. He studied in the public schools of Chicago and at the Altenburg Gymnasium in Germany, and graduated from Yale Law School in 1883. Soon after he engaged in the practice of law in Chicago, in which he continued until 1889, and subsequently published the Chicago *Times*. In 1897 he was elected mayor of Chicago and afterward was elected for terms beginning in 1899, 1901, 1903, and 1911. Harrison merits mention because of his reform movements in municipal government and ability as a public speaker. He came prominently before the country as an advocate of the election of Bryan for President. His father, Carter Henry Harrison, was mayor of Chicago for five terms and was assassinated on Oct. 30, 1893, by a disappointed applicant for office.

HARRISON, Constance Cary, authoress, born near Alexandria, Va., April 25, 1845; died Nov. 21, 1920. She was educated in private schools. In 1867 she married Burton Harrison, who had been Jefferson Davis's private secretary. Her magazine articles and promiscuous writings take very high rank on account of her keen appreciation of domestic themes and peculiar native ability to narrate in an interesting style. Among her best known writings are "Anglomaniacs," "Sweet Bells Out of Tune," "A Bachelor Maid," "Errant Wooing," "A Daughter of the South," and "Flower de Hundred." The "Unwelcome Mrs. Hatch" is a popular play.

HARRISON, William Henry, ninth President of the United States, born in Berkeley, Va., Feb. 9, 1773; died April 4, 1841. He was the third son of Benjamin Harrison, a signer of the Declaration of Independence, and grandfather of Benjamin Harrison, twenty-third President of the United States. He entered upon the study of medicine, after attending Hampden-Sidney College, but was induced to enter the army because of Indian outrages on the western frontier, receiving a commission for the service in 1791. The next year he was appointed lieutenant and in 1794 distinguished himself by much gallantry on the Miami. In 1797 he was made captain and given command

of Fort Washington, and while there married Anna Symes. When peace was declared in 1798, he resigned his commission, and in 1799 became a delegate to Congress from the Northwest Territory. When Indiana Territory was formed, in 1800, which included the present states of Michigan, Indiana, Illinois, and Wisconsin, he was appointed its governor and superintendent of Indian affairs, and continued in these positions under appointments by Presidents Jefferson and Madison. During his time of service he organized the Legislature at Vincennes in 1805, acquired by purchase large tracts of land for the government, and established a military post at Tippecanoe because of depredations committed by the Indians in 1811. On Nov. 7, 1811, he quelled an outbreak under Tecumseh, which ended in a battle at Tippecanoe, hence he became known as the "Hero of Tippecanoe."



WILLIAM H. HARRISON.

In 1812 Harrison was commissioned brigadier general in the regular army and later made commander in chief of the northwestern army, in which position he rendered valuable service during the War of 1812 by repulsing General Proctor at Fort Meigs and by assisting Commodore Perry on Lake Erie. On Oct. 5, 1813, he routed the British and Indians in the Battle of the Thames, for which he was highly complimented by President Madison. He resigned his commission in 1814 and was elected to Congress two years later, serving in the lower house until 1819. In the same year he was chosen to the senate of Ohio, was a presidential elector in 1824, voting for Henry Clay, and in that year was elected to the United States Senate. President John Quincy Adams appointed him minister to Colombia in 1828, but he was recalled by President Jackson in 1829, and for twelve years served as county clerk in Ohio. The Whigs nominated him for President in 1836, but he was defeated by Martin Van Buren, receiving only 73 electoral votes, while his opponent received 170. The Whigs nominated him again in 1840, when 234 electoral votes were cast for him and 60 for Martin Van Buren. He died one month after his inauguration and was succeeded in the Presidency by John Tyler, the Vice President.

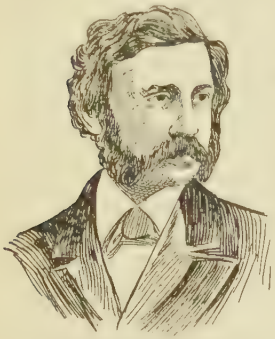
HARROW, an implement for pulverizing and smoothing plowed land, either before or after sowing the seed. It consists of an iron or a wooden frame, either square or rhomboidal, to which iron teeth are fastened by bolts or otherwise. Originally the harrow was made entirely of wood, but later iron teeth were driven through the woodwork, projecting downward about eight inches, and now many harrows are entirely of metal. Revolving disks of steel, fastened to heavy iron bars, have to some extent displaced the common harrow. The work with these implements is done by dragging them across the land with horses or mules.

HART, Albert Bushnell, historian, born in Clarksville, Pa., July 1, 1854. In 1880 he graduated from Harvard University and subsequently studied in Paris, Freiburg, and Berlin, and on his return to America, in 1883, was made instructor of history at Harvard. Successful work caused him to be appointed full professor in 1897. He became editor in chief for the American Historical Association of an extensive history of the United States projected by that society. Besides publishing a large number of historical works, he served on the editorial staff of the *American Historical Review* and the *Harvard Graduates' Magazine.* His writings include "Practical Essays on American Government," "Guide to the Study of American History," "Introduction to the Study of Federal Government," "Life of Salmon P. Chase," "Source Books of American History," and "Foundations of the American Foreign Policy."

HART, Joel T., sculptor, born in Clark County, Kentucky, in 1810; died in Florence, Italy, March 1, 1877. He was self-educated, began to model busts in clay while earning a living as stonecutter in Lexington, and first attracted attention by preparing likenesses. The citizens raised a fund and sent him to Rome, where, in 1849, he modeled a statue of Henry Clay, a production now in the capital square at Richmond, Va. Other well-known works are a colossal bronze statue of Henry Clay, now in New Orleans, and a fine marble statue in the courthouse at Louisville, Ky. His productions show delicacy of touch and refined fancy. Many of them are idealistic and present a characteristic and truthful likeness of the subjects after which they are modeled. The latter portion of his life was spent in Italy, where he produced many praiseworthy pieces of art.

HARTE, Francis Bret, novelist and poet, born in Albany, N. Y., Aug. 25, 1839; died May 5, 1902. Being the son of a school teacher, he at first designed to follow that profession. In 1854 he went to California and engaged in mining, but subsequently became a compositor in a printing office. His ability as a writer soon made a place for him as editor of the *Golden Era.* In 1868 he founded the *Overland Monthly,* in which he published many of his writings, including "The Heathen Chinee," "The Luck of Roaring Camp," "Society Upon the Stanislaus," "The Outcasts of Poker Flat," and "Truthful James." The success of these productions brought him into public notice and he soon became a favorite contributor to the *Atlantic Monthly* and other magazines.

In 1870 he was made professor of recent literature in the University of California, but removed to New York the following year. Soon after he was appointed consul at Crefeld, Germany, and in 1880 made consul at Glasgow, Scotland. While in Great Britain he never tired of making literary research, producing many popular works, his later writings being largely in the line of fiction. Among those not already named are "Tales of the Argonauts," "Crusade of the Excelsior," "Waif of the Plains," "Ward of the Golden Gate," "Thankful Blossom," "John Burns of Gettysburg," "In a Hollow of the Hills," "Dickens in Camp," and "Sappho of Green Springs."



FRANCIS BRET HARTE.

HARTFORD (härt'fĕrd), a city and the capital of Connecticut, county seat of Hartford County, on the Connecticut River, 110 miles northeast of New York City. It is on the New York, New Haven and Hartford and the Connecticut Valley railroads. The large vessels reach it from Long Island Sound, which is 50 miles distant, and it has communication by many electric lines. It has a fine site, which commands a view of the Connecticut valley. The streets are regularly platted and improved with grading and stone and asphalt pavements. Charter Oak Park contains the race tracks and fair grounds. The State capitol is located in Bushnell Park, which embraces 46 acres.

Hartford is generally well built and has many large and modern structures. The State capitol, which is built of white marble, is a large and imposing building. The city hall, which was formerly the State house, is famous as the seat of the Hartford Convention. Other noteworthy buildings include the post office, the Hartford Theological Seminary, the Dillon building, the Saint Joseph Cathedral, the Wadsworth Athenaeum, and the buildings of the Aetna Life, the Phoenix Mutual Life, and the Connecticut Mutual Life insurance companies. It is the seat of institutions for orphans, for the insane, and for aged people. Trinity College, an Episcopal institution, is located in the city. The library of Trinity College has 50,000 volumes, and, besides it, there are several other libraries. Hartford has been a port of entry since 1887 and has an extensive commercial and insurance business. The manufactures include typewriters, rubber tires, brushes, aircraft, bread, firearms, machinery, hardware, flour, bicycles, stoves, and furniture. In 1633 the Dutch built a fort on its site and in 1635 a colony settled here from Massachusetts. It was incorporated as a city in 1734 and until 1873 was the joint capital of the State with New Haven, but in that year became sole capital. Among the sights of interest shown visitors for a number of years was the celebrated Charter Oak, the tree in which the charter of Connecticut was hidden when Governor Andros demanded its surrender. Population, 1920, 138,036.

HARTFORD CITY, a city and the county seat of Blackford County, Indiana, 72 miles northeast of Indianapolis. It is on the Pennsylvania, the Nickel Plate, the Union Traction Line, and other railroads. The chief buildings include the courthouse, the high school, and several fine churches. It has manufactures of flour, paper, glass, bread, and machinery. Electric lights, telephones, waterworks, and a library are among the facilities. Population, 1900, 5,912; in 1920, 6,183.

HARTFORD CONVENTION, an association of delegates proposed by the Legislature of Massachusetts. It convened at Hartford, Conn., Dec. 15, 1814, and adjourned Jan. 5, 1815. The Federalists of the New England states opposed the war with Great Britain, which was then in progress. The war was especially injurious to the interests of New England because it operated to destroy the commercial importance and the fisheries of that region. The object of the convention was to devise means for security that would prevent total destruction, but it met behind closed doors, and was carefully watched by a government military officer. From time to time the conclusions of the convention were published in the form of measures looking to the protection of the citizens against compulsory military service, but there was a widespread suspicion that the members of the convention designed to disseminate a sentiment favorable to the establishment of a kingdom in New England. Since the delegates consisted of leading Federalists who had favored an eastern confederacy in 1804 and the work of the convention was designed against the Democratic administration, a public sentiment was formed against the Federalists and entirely ruined them as a party in the election of 1816. Subsequently it was shown conclusively that the reports of treason were not well founded and that the delegates had in mind only the interests of their section of the Union.

HARTMANN (härt'män), **Karl Robert Eduard,** philosopher, born in Berlin, Germany, Feb. 23, 1842; died June 6, 1907. He studied for the artillery and in 1858 entered the Prussian army, but resigned his commission in 1865 on account of having injured a knee by accident. Subsequently he took up literature and studied advanced courses in philosophy. His best known work, "The Philosophy of the Unconscious," published in 1869, has gone through numerous editions. Many of his theories have been discussed widely owing to their being opposed to doctrines advocated by Hegel and Schopenhauer.

(Opp. 1260)

HARVESTING ON THE PRAIRIES OF CANADA

(Opp. 1260.)

HARVESTING MACHINES.

The above shows a modern harvesting machine (a header) at work, as seen in the wheat fields of the western part of Canada and the United States.

His principal publications include "Christianity and the Religions of the Future," "Aphorisms Regarding the Drama," "Truth and Error of Darwinism," "Reforms of Higher School Work," "History and Foundation of Pessimism," and "Shakespeare's Romeo and Juliet."

HARTSHORN (härts'hôrn), a volatile preparation of ammonia, now obtained from carbonate of ammonia and other sources, but formerly prepared from the horn of the common stag. The product was derived by distillation and sold as oil of hartshorn or spirits of hartshorn. It is employed for many purposes in medicine, especially in cases of fainting and nervous weakness. The scent is very strong, serving as a relief in headache.

HARUN-AL-RASHID. See **Haroun-al-Raschid.**

HARVARD (här'vẽrd), **John,** clergyman, born at Southwark, England, in 1607; died Sept. 24, 1638. He studied at Emmanuel College, Cambridge, and later took a course in theology. In 1627 he married Ann Sadler, the daughter of a clergyman of Sussex, and came to Charlestown, Mass., where he officiated as a pastor, but died of consumption the following year. He gave his library and an estate of $2,000 for the purpose of establishing a college at New Towne, now Charlestown, Mass. The general court of Massachusetts had already appropriated $2,000 for the same purpose, and the institution was founded in 1838 as Harvard College, which afterward became Harvard University.

HARVARD UNIVERSITY, an important institution of higher learning, situated in Cambridge, Mass. It was founded under an appropriation of $2,000 voted by the general court of the Massachusetts Bay Colony and established on Oct. 28, 1636, being the oldest university in the United States. No material advancement was made until 1638, when John Harvard bequeathed half his estate valued at $4,000 and his library of 300 volumes to the proposed institution. In the same year it was organized as Harvard College. The first class of nine graduates completed the course in 1642. Henry Dunster, the first president, succeeded in obtaining a charter on May 31, 1650, when it was legalized as the President and Fellows of Harvard College. This document was signed by Gov. Thomas Dudley and is now in the custody of the trustees. It provides for the management under a board of overseers, but the character of this board has been changed by several acts of the State Legislature. At present the candidates for members of the board are nominated by postal ballot, both residents and nonresidents of the State being eligible, and the election is held annually on commencement day.

The name Harvard College is still used to designate the central portion, which grants the degree of A. B., while the entire complex institution is known as Harvard University. As a whole it includes seventeen departments, each of which is finely equipped with such aids in teaching as are demanded in its particular line. At present there are about 40 college buildings, an endowment fund of $70,500,000, and departmental libraries with 2,215,000 volumes and 485,500 pamphlets. In 1926 it had 1,171 instructors and 8,472 students, of whom 143 were from foreign countries. The courses include those of law, divinity, medicine, zoölogy, veterinary, dental science, and liberal arts. In connection with it is a college of liberal arts for women. The laboratories and observatory are thoroughly equipped. Its museum of comparative zoölogy is known as the Agassiz Museum, from the circumstance that it was endowed by Professor Agassiz. In 1907 the university celebrated the 300th anniversary of the birth of its founder.

HARVEST BUG, the name of a mite of a bright red color, so called from the fact that it attacks the workmen at harvest. It makes its appearance in July, when it is found on blades of grass, whence it comes in contact with the legs and thighs of persons in the field. It is annoying both to man and various animals, such as dogs and sheep. The mite is very small and causes an intolerable itching of the skin.

HARVESTING MACHINERY, the implements used in harvesting the crops of agriculturalists. The first machines of this character known in history were used by the Gauls before the Christian Era. It consisted of a box fixed on wheels and had a cutting apparatus in front that gathered the heads of standing grain as an ox pushed the machine from the rear. At present three principal classes of machines are used for harvesting small grain. These are known as headers, reapers, and harvesters. *Headers* are utilized for cutting the heads of standing cereals, as wheat and oats, and some of the more modern structures thresh and bag the grain while the machine is propelled forward, though in most cases the heads are gathered and threshed afterward. In *reapers* the grain is cut, bound by hand, and, after being stacked, or stored in barns, is threshed by machines. *Harvesters* consist either of self-binders, which bind the grain with sisal or manilla cord and carry the bundles into rows upon the field, or machines on which two men bind the grain by hand, though the latter form has gone practically out of use. Besides the implements employed in harvesting small grains, there are numerous machines for cutting grass, clover, and corn.

Among the earliest of the modern machines were those of Patrick Bell, who patented a harvester in Scotland in 1826, and the machine invented by Cyrus H. McCormick in the United States in 1834. Since then various excellent implements have been invented for harvesting many grains and grasses with the result that all classes of farming have become more profitable. They give the advantage that harvesting may be carried on with much less physical exertion than formerly. As a consequence agricultural

enterprises have been extended over vast areas formerly not cultivated. In the manufacture of harvesting machines the United States has long occupied the foremost position. Its products have gone into all the markets of the world. The machines of newer manufacture are almost exclusively of steel, which has been made serviceable because of improved methods of tempering metals. The improvements due to the general use of ball bearings has greatly lightened the draft of machines on the one hand and increased their durability on the other. See **Corn Harvester.**

HARVEST MOON, the name given to the moon at the time she is in that part of her orbit where she makes the least possible angle with the ecliptic. This occurs about the autumnal equinox, in September, in high northern latitude and during March in southern latitude. Ordinarily the moon rises about fifty minutes later each succeeding evening, owing to her changing position in the sky, this difference being called *retardation.* At the time of full moon, during the autumnal equinox, when the retardation is at a minimum, the farmers have the advantage of moonlight nearly the entire night on several successive nights.

HARVEY, a city of Illinois, in Cook County, twenty miles south of the courthouse in Chicago, on the Illinois Central, the Cleveland, Cincinnati, Chicago and Saint Louis, the Grand Trunk, and other railroads. It is a residential and manufacturing suburb of Chicago. Population, 1900, 5,395; in 1920, 9,216.

HARVEY, George B. M., diplomat, born at Peacham, Vt., Feb. 16, 1864. He studied at Peacham Academy and in 1887 married Alma A. Parker. He engaged as reporter of the *Chicago News* and in 1890 became managing editor of the *New York World.* In 1899 he purchased the *North American Review,* was for many years editor of *Harper's Weekly,* and in 1921 President Harding appointed him ambassador to England; he resigned in 1923. He died Aug. 20, 1928.

HARVEY, William, discoverer of the circulation of the blood, born in Kent, England, April 1, 1578; died in London, June 3, 1657. He attended the Canterbury grammar school until 1594, graduated at Cambridge in 1597, and in 1602 was granted a doctor's degree at the University of Padua. In 1616 he brought out his views on the circulation of the blood and two years later published "On the Movement of the Heart in Blooded Animals," which appeared at Amsterdam and made known his views relative to the circulation of the blood. In the preface he stated that he had established the theory by investigations covering nine years and answered objections made to them by the most skillful anatomists holding contrary views. In 1623 he became physician to James I. and in 1632 to Charles I. With the latter he was present at the Battle of Edgehill and in 1656 resigned as lecturer in the College of Physicians, a position he held for forty years. Oxford granted him a degree, and he was the recipient of many distinguished honors. His practice was almost ruined when his views were first announced relative to the circulation of the blood.

HARZ (härts), or **Hartz,** the most northerly mountain chain of Germany, extending between the Weser and Elbe and trending from the northwest to the southeast. The range is about twenty miles wide and sixty long, rising quite abruptly from the plains in irregular ridges. It is covered in many places with native forests. The average elevation is about 1,500 feet. Brocken, the predominating peak, is elevated 3,741 feet above sea level. The range is divided into two portions, the southeasterly being known as the Lower Harz and the remainder as the Upper Harz, the latter being the higher and including Brocken. Many historic incidents are connected with these mountains, chiefly because they form a natural boundary between the High and Low German peoples. They have entered largely into German literature, lending a realistic vividness to poetic imagination. The mineral deposits are exceedingly rich, including zinc, copper, silver, iron, arsenic, lead, marble, granite, slate, alabaster, and porphyry. The region has valuable forests, fertile valleys, and fine pasture lands.

HASDRUBAL (hăz'drụ-bal), or **Asdrubel,** the name of several generals of Carthage, of whom the son-in-law of Hamilcar was the most distinguished. He operated with Hamilcar in Spain from 236 B. C. until the death of the latter in 228, when he became the commander in Spain. Within this period the Carthaginian possessions were advanced from the Guadalquivir to the Tagus and the present city of Cartagena was founded as the capital. Not only did he possess the ability of a successful warrior, but encouraged agriculture, built palaces, constructed highways and canals, and brought about a general era of prosperity. His influence was rather that of an administrator than a warrior. He was so powerful in statesmanship that Rome treated with him in regard to boundary regulations rather than with the government of Carthage. In 220 he was assassinated by a Celtic slave. Another Hasdrubal of much eminence was the brother of Hannibal, hero of the Second Punic War. He commanded the army in Spain in 218 B. C., when Hannibal was operating in Italy, and conducted military operations against Publius Scipio. In 207 he led an army into Italy to assist Hannibal, but was defeated and slain on the banks of the Metaurus. His head was thrown into the camp of Hannibal, under the command of Nero, as an announcement to the former that his brother had fallen.

HASHISH (hăsh'ēsh), or **Hasheesh,** a term applied to the tops and tender sprouts of a variety of hemp native to India and to an intoxicating preparation made of this plant. Hashish, in various forms, is smoked, drunk, and taken

in confections. The habit of using hashish prevails extensively in the East, where it enters to some extent into the practice of medicine. The juice of the plant contains narcotic properties and exudes from it in the form of resinous matter. Whether taken as a beverage, with confections, or smoked, it has a marked stimulating influence. When taken in excessive quantities, it has an intense intoxicating effect, which is accompanied by results quite similar to those affecting persons using alcoholic beverages excessively. The effects partake largely of the nature of hallucinations and merriment, but are frequently accompanied by boisterous, quarrelsome tendencies.

HASTINGS (hāst'ĭngz), a seaport of England, on the Strait of Dover, in Sussex County, 54 miles southeast of London. It forms, together with Saint Leonards, an important railroad and trade center. The principal industries are fishing and boat building. During the greater part of the year it is frequented by large numbers of invalids, who bathe in its waters or take treatment for pulmonary complaints. The town is of great antiquity, possessing importance in the early times of the Anglo-Saxons. King Harold garrisoned it as a means of defense against William the Conqueror, but it surrendered to the latter without much resistance. He made it his permanent base of operations and on Oct. 14, 1066, the celebrated Battle of Hastings occurred between the two leaders at Senlac Hill, in which Harold was defeated and his army was destroyed. This battle is classed among the fifteen decisive engagements of the world. Population, 1921, 61,146.

HASTINGS, a city in Nebraska, county seat of Adams County, situated in a fertile agricultural country, 95 miles west of Lincoln. It is on the Missouri Pacific, the Chicago and Northwestern, the Chicago, Burlington and Quincy, and other railroads. Among the public buildings are the city hall, the Masonic temple, the county courthouse, the State asylum for the insane, a Roman Catholic academy, Hastings College, and the high school. It has a large trade in live stock, cereals, and fruits. The city has waterworks, electric lights, street railways, and a public library. The manufactures include flour, canned and packed goods, pottery and brick, machinery, utensils, and cigars. Hastings has an extensive jobbing trade. It was incorporated in 1874. Population, 1920, 11,647.

HASTINGS, Warren, first Governor General of British India, born in Churchill, England, Dec. 6, 1732; died Aug. 22, 1818. He was left an orphan at an early age, attended the Westminster school, and when seventeen entered the service of the East India Company as writer. From 1758 to 1761 he represented the company at Moorshedabad. In the latter year he was removed to Calcutta and three years later returned to England. In 1769 he reëntered the service of the company and was stationed at Madras, but in 1772 was made president of the council at Bengal. The Regulating Act passed by Parliament in 1773 modified the power of the company and Hastings became Governor General, being associated in the government by a council of five. His policy was opposed by a majority of the council, which led to financial and internal difficulties, and he resigned in 1776.

Hastings again accepted the office of Governor General in 1777 and displayed much administrative and reformatory ability. Complications arising with several native forces of the Deccan and Mysore, he made use of severe means to procure the necessary funds to conduct defensive movements, which gave rise to opposition in the House of Commons and resulted in his resignation in 1784. Soon after he was called before Parliament on charges of bribery and misappropriation of funds, but was acquitted after spending his fortune in the defense. The trial became celebrated on account of the active interest taken by such eloquent speakers as Fox, Burke, and Sheridan, who opposed him with all their force of oratory, unmindful that Hastings had established English dominion in India, though, perhaps, making some mistakes. His acquittal was announced in 1795 and the East India Company settled an annuity of $20,000 on him the following year, and extended to him a loan of $250,000 without interest for a term of eighteen years. After this he lived in retirement at Daylesford.

HAT, a covering for the head, generally with a crown and brim and of various materials, shapes, and styles. The manufacture of hats originated with the ancients, who employed different fibers for making outdoor covering for the head. Hats began to resemble those now worn at the time of Alexander the Great, when the Greeks made hats of round felt called *petasos.* Extensive manufactures of headwear began in Western Europe in the 15th century.

HATTIESBURG, county seat of Forest County, Mississippi, 86 miles southeast of Jackson, on the Pascagoula River and on the Mississippi Central, the Illinois Central, and other railroads. It has extensive machine shops, cotton compressers, and lumber works. The buildings include the courthouse, city hall, high school, federal building and the Normal College. The place was settled in 1883 and incorporated in 1884. Population, 1920, 13,270.

HATTON, Joseph, novelist and playwright, born at Andover, England, Feb. 3, 1841; died July 31, 1907. He studied in his native city and Chesterfield and soon began to contribute to the Derbyshire *Times,* a paper established by his father. In 1868 he began to contribute to magazines and took up correspondence for newspapers in America, Germany, and Australia. He became editor of *The People* in 1900 and in it published his popular "Cigarette Papers." He dramatized "The Scarlet Letter" for Richard Mansfield and "John Needham's Double"

the English in 1762, at which time it was the center of trade in the West Indies, but it remained under Spanish dominion until 1898, when it was occupied by the United States and the revolutionists. On Feb. 15, 1898, the United States battleship *Maine* was destroyed in the harbor of Havana while on a friendly visit and 262 officers and men were lost. About one-fifth of the inhabitants are of foreign birth. Population, 1902, 262,395; in 1921, 379,884.

HAVELOCK (hăv'ę-lŏk), **Sir Henry,** soldier, born in Durham, England, April 5, 1795; died Nov. 22, 1857. He was the son of a shipbuilder, who made provision for his education at the Charterhouse School, and in 1815 he entered the army. In 1823 he was sent to India, where he distinguished himself in the Burmese War in 1824-26. Later, in 1856, he was dispatched to Allahabad to support the forces at Lucknow against the Indian mutiny and later to relieve those at Cawnpore. With a force of 2,000 men he reached Cawnpore, where he found that Nana Sahib had massacred the English prisoners. He proceeded at once in his march upon Lucknow and defeated the enemy in eight successive battles, but retreated with his greatly diminished army to Cawnpore, where he was shut up until relieved on Nov. 17, 1857, by Sir Colin Campbell. Havelock served his country with heroic bravery. He died of dysentery at Dilkusha. The title of honor intended for him, that of Knight Commander of the Bath, was conferred upon his eldest son, while a pension of $5,000 per year was given to his widow.

HAVERFORD COLLEGE (hăv'ĕr-fĕrd), an institution of learning established by the Society of Friends at Philadelphia, Pa., in 1830. It was opened for instruction in 1833. The purpose is to supply the need of religious training as well as literary culture. It has a faculty of 30 instructors and about 250 students. At present the endowments amount to $3,800,000. The library contains 100,000 volumes.

HAVERHILL (hā'vĕr-ĭl), a city of Massachusetts, in Essex County, on the Merrimac River, 32 miles north of Boston. It is on the Boston and Maine Railroad and has an extensive system of electric railway lines. The site overlooks the river, which is crossed by a number of iron bridges, connecting it with Groveland and West Newbury. Among the noteworthy buildings are the public library, the city hall, the Masonic Temple, the Hale Hospital, and a number of fine churches and schools. Haverhill is the birthplace of John G. Whittier. It contains a monument to commemorate the historic liberation of Hannah Dunston from her Indian captors in 1697. The city takes high rank in the manufacture of boots and shoes. Other products include fine hats, leather, brick, clothing, woolens, and machinery. It has a large trade in merchandise. The place was settled about 1640. It was chartered as a town in 1645 and incorporated as a city in 1870. Population, 1905, 37,818; in 1925, 49,232.

HAVERSTRAW (hăv'ĕr-strą), a village of Rockland County, New York, on the Hudson River, 35 miles north of New York City. It is on the West Shore and the New Jersey and New York railways. At this place the river expands to form Haverstraw Bay. The town has manufactures of brick, paper, and copper products. It was settled by the Dutch and became a precinct in 1719. The home of Thomas H. Smith, known as the "Treason House," was the meeting place of Arnold and André. Population, 1905, 6,182; in 1920, 5,226.

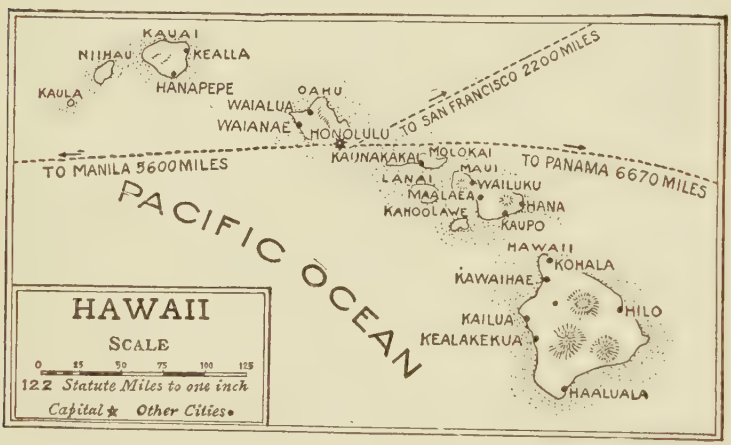
HAVRE (hä'vĕr), a city and seaport in the department of Seine-Inférieure, France, on the estuary of the Seine, about 108 miles northwest of Paris. Besides numerous steamboat lines, it has connections by a network of railroads. The noteworthy buildings include the palace of justice, the customhouse, the museum, the Church of Notre Dame, and the commercial exchange. It dates from 1516, when it was a small fishing village, but its harbor was improved and fortified by Francis I., after which it grew to importance. At present it ranks next to Marseilles as the most extensive commercial center of France. It has manufactures of paper, cotton and woolen goods, clothing, earthenware, chemicals, cordage, oil, glass, beet sugar, and machinery. Its export trade with the United States is extensive. It is noted for its large emigration traffic, the most important of France. The city has beautifully improved streets, including electric lights and street railways, waterworks, public parks, and stone pavements. Population, 1921, 136,159.

HAWAII (hä-wī'ē), or **Hawaiian Islands,** a group of eight principal islands in the Pacific ocean, formerly called Sandwich Islands, and now known politically as the Territory of Hawaii. They are located about 2,200 miles southwest of San Francisco and 4,890 miles from Hong Kong. Geographically they form the extreme northeastern group of Polynesia and extend in a chain from southeast to northwest for about 400 miles. Eight of the islands are inhabited. The entire group has an area of 6,450 square miles. In 1928, the total population was 328,444. The following is a list of the eight principal islands, in which is shown the area:

	AREA, SQ. MI.
Hawaii	4,015
Kahoolawe	69
Kauai	544
Maui	728
Lanai	135
Molokai	262
Niihau	97
Oahu	600
Total	6,450

DESCRIPTION. The islands are volcanic in origin, having been raised by eruptions from the sea, but considerable surface has been added

through the growth of coral reefs. Groups and chains of mountains occur in the larger islands, the most elevated peaks being in Hawaii, the largest island, where Mauna Kea rises to a height of 13,805 feet and Mauna Loa, 13,675 feet. Kilauea, one of the most noted volcanoes in the world, is situated on the eastern slope of Mauna Loa. The most recent eruptions of this crater occurred in 1887 and 1924, when lava flowed for a period of several months, spreading when ejected for some distance from the crater. Some of the coasts are low and sandy, but nearly all the islands have bold cliffs that rise quite abruptly from the sea. Kauai and several other islands are eroded with deep ravines and gorges and the coast is more or less indented with deep bays. Fertile plains and valleys extend between the mountains and the coasts. Few lakes and rivers characterize the surface and the streams are chiefly short mountain torrents. Most of the creeks and rivulets are located on the northern slopes.



The climate is mild and temperate and the thermometer seldom falls below 50° Fahr. and rarely rises above 90°. In the lowlands the average temperature is 70° in January and 78° in July. Summer and winter make up the two seasons. The rainfall is greatest in winter, when the northeast trade winds cause considerable precipitation. Vegetation is most abundant on the northeastern side of the highlands, owing to this fact, and in Hawaii Island an almost arid tract is located on the southwestern sides of the mountains. The rainfall at Honolulu is 32 inches per year, but in some localities it ranges from 80 to even 240 inches. Europeans find the climate agreeable and healthful, though it is not favorable to those who are afflicted with pulmonary diseases. Hurricanes and thunderstorms are rare and frosts occur only on the mountains, where snow sometimes remains several months, though only on the highest peaks.

Flora and Fauna. The plants resemble those of Australasia, but include some species common to America. Many flowering plants have been described, of which fully 600 are peculiar to the islands. Formerly the forests were very abundant, especially those of the screw pine, and large areas of the uplands still have considerable timber. Tree ferns are especially numerous and all of the vegetation is luxuriant. Birds of song and plumage are few, and the mammals are not well represented. Aside from a species of lizards there are no reptiles. The mammals include wild swine, rats, and dogs. Insects common to the tropics occur here.

Transportation. The harbor of Honolulu is protected by a coral reef and is counted one of the best in the Pacific. Pearl Harbor, a short distance north of Honolulu, may ultimately be made the chief center of commerce, as it has unlimited port facilities. In general the islands have good landing places, since the water near many of the shores is deep. Steamers land regularly on routes out of San Francisco, Hong Kong, Vancouver, Yokohama, and ports in Australia and New Zealand. Railways have been built on several of the islands, the largest mileage being on Oahu, where a line extends from Honolulu along the coast to Kahuku. Several short lines are in operation, including a number that transport commodities from and to the sugar plantations.

Industries. Agriculture is the chief industry. The climate and soil are favorable to the cultivation of a large variety of plants, but considerable of the surface is mountainous and much of the area is covered with lava. Sugar cane is cultivated extensively and the sugar industry is the most important industrial enterprise. It is confined largely to the low plains, where the soil is exceptionally fertile, and the higher lands are utilized for raising pineapples and other fruits. The level lands near the sea are well adapted to cultivation. Pineapples rank next to sugar cane in the acreage, and much of the crop is consumed in canning. Bananas are grown most extensively of the fruits and considerable quantities are exported. Potatoes thrive and corn can be raised profitably in some localities.

The islands do not contain coal deposits, hence the supply of fuel is quite limited. This has had a marked influence upon manufacturing enterprises, which are confined chiefly to the products obtained through the sugar plantations. Sugar is the principal manufactured product, and next are canned pineapples, and clothing. Among the chief minerals are

basalt, sandstone, and coral rock, but no metals abound. The export trade is chiefly with continental United States and has been augmented by the fact that home manufactures are limited. Coal is the most important import and is followed by machinery, clothing, and utensils. The chief exports include sugar and fruits. Cattle, hogs, horses, mules, and sheep are reared. The imports are obtained largely from Asiatic countries and continental United States.

Education. Education is free, universal, and compulsory. A department of public instruction, consisting of a superintendent of public instruction and six commissioners appointed by the Governor, have control of education throughout the Territory. It has 182 public schools with 58,860 pupils and employs 1,977 teachers. There are 63 private schools with 9,651 pupils that employ 400 teachers. A college of agriculture and mechanic arts, established by the Territory at Honolulu in 1908, is maintained jointly by the Territory and the Federal government. A normal school, a high school, and a girls' industrial school, at Honolulu; a boys' industrial school at Waialua; Lahainaluna School, an industrial and manual training school for boys, at Lahaina; and a high school at Hilo, are maintained by the department of public instruction. Of schools on private foundation are Oahu College, Kamehameha Schools, Saint Louis College, Iolani College, Mills Institute, Kawaiahao Seminary, Convent of Sisters of the Sacred Heart, and Saint Andrew's Priory, at Honolulu; Maunaolu Seminary for Girls, at Makawao; Hilo Boarding School, at Hilo; and Kohala Seminary, at Kohala. The English language is the basis of instruction in all schools.

Government. The government has been that of a territory since 1900. It has a territorial delegate in Congress and the chief executive is a Governor, who is appointed by the President of the United States. Legislative power is vested in a senate of fifteen, elected for four years, and a house of representatives of thirty members, elected for two years. The chief charitable institution is the leper settlement on the island of Molokai, at which about 900 are provided for by public grants. This settlement is on a peninsula which is isolated from the mainland by mountains and those confined here are permitted a large measure of local self-government. A large majority of the people of Hawaii are Protestants, but the Catholics and various Oriental faiths are represented.

Inhabitants. The inhabitants are greatly diversified, consisting of Japanese, Chinese, Caucasians, Hawaiians, and South Sea Islanders. Immigration from the United States has been considerable since the islands were annexed. At present there are about 4,250 inhabitants who were born in the United States and the total foreign born population is placed at 12,500. In 1778, when Captain Cook visited the islands, the native population was estimated at 400,000, but the census of 1925 shows that the purely native inhabitants number only 21,145. In the same year the total population was 328,444, which included 24,851 Chinese, 71,678 Caucasians, and 128,068 Japanese. Honolulu, on the island of Oahu, is the capital and principal city. Hilo, on the island of Hawaii, has a population of about 12,200. The inhabitants have increased within recent years. In 1921 the population was 259,208.

History. The island group was discovered in 1542 by Gaetano, a Spanish explorer. It was visited by Captain Cook in 1797, who was killed by the natives the following year. The government previous to the last century was vested in separate kings resident on the different islands, but in the early part of the century Kamehameha I. consolidated them into one monarchy, in which form they were governed by him and his successors until about 1886, when the people secured numerous concessions. Kamehameha II., who was friendly to Europeans and encouraged missionary work, visited England and in 1824 died at London. A constitution was granted to the people in 1840 by Kamehameha III., and the former despotic government was succeeded by a limited monarchy, in which the affairs were in the hands of the king and an assembly of nobles. During his reign Europeans governments came to look upon the islands as important on account of their position, and France and England united in guaranteeing their independence in 1843. Kamehameha IV. ascended the throne in 1854 and was succeeded by Kamehameha V. in 1863, but the latter died ten years later and the Kamehameha dynasty became extinct.

In 1874 Kalakaua was elected as king. He reigned successfully until 1891, when he was succeeded by his sister, Queen Liliuokalani. The government of this queen did not meet with the approval of the large foreign element and the progressive party, since she adopted a policy to set aside the constitution. She was deposed in January, 1893, when a republic was organized. Sanford B. Dole was chosen provisional president and was confirmed chief executive of the islands on July 4, 1894, when the new government was officially proclaimed.

Annexation to the United States was advocated immediately after the republic was proclaimed. President Dole visited Washington to promote an interest in making the islands territory of the United States. Congress soon after passed a joint resolution, which was approved by President McKinley, and the islands were officially annexed on July 7, 1898. To carry out the provisions of annexation, a commission was sent to the islands with instructions to formulate a plan of government. On August 12, 1898, Annexation Day was celebrated at Honolulu with imposing ceremonies, and the islands were formally declared a possession of

the United States in the presence of a great crowd. In 1900 the islands were organized as a territory and in that year Sanford B. Dole became the Governor. Since then Hawaii has grown steadily in wealth and population.

HAWK, the name of several species of birds. It is frequently applied to all birds of prey, except the vultures, owls, and eagles. The falcons are included with the hawks proper, though the latter differ from them in that their beaks are smaller and the wings are shorter. The

GOSHAWK. SPARROW HAWK.

goshawk and sparrow hawk are widely distributed in the continents and islands. They are noted for their rapacious and fierce habits and the swiftness with which they pursue animals and birds for the purpose of catching them. The American hawk preys upon insects, small quadrupeds, and domestic chickens. It is a common bird in many parts of the United States and Canada. The color of most species of hawks is grayish-brown. See **Falcon.**

HAWKINS (hạ'kĭnz), **Anthony Hope,** novelist, born in London, England, Feb. 9, 1863. He studied in Marlborough and at Oxford and in 1887 was admitted to the bar. After practicing his profession a short time, he devoted himself chiefly to literature. He visited Canada and the United States in 1897. His writings are admired for their precision and vigorous style. They include "A Man of Mark," "The Prisoner of Zenda," "The Heart of Princess Osra," "Mr. Witt's Widow," "The Guest of the Sangraal," "The Intrusions of Peggy," and "A Servant of the Public."

HAWKINS, Sir John, sailor, born in Plymouth, England, about 1532; died in Porto Rico, West Indies, Nov. 21, 1595. He became a seaman at an early age, sailing to Spain and Portugal. He was the first English slave trader, which he became in 1562. After making several voyages in the interest of the slave traffic, he engaged in the business, sailing with a squadron to the coast of Guinea in 1562. In 1573 he was made treasurer of the British navy and was knighted in 1588 on account of valuable service against the Armada of Spain. Though an efficient seaman, he was rude and avaricious.

HAWKSBILL, or **Caret,** the name of a large sea turtle. It is found in the tropical sea and different species inhabit the Indian and Pacific oceans. The beak is horny and formed somewhat like that of a bird of prey and the tail is used as a weapon of defense. This turtle furnishes the tortoise shell of commerce.

HAWLEY (hạ'lĭ), **Joseph Roswell,** statesman, born in Stewartsville, N. C., Oct. 31, 1826; died March 18, 1905. He removed with his parents to Connecticut, graduated from Hamilton College, New York, in 1847, and three years later was admitted to the Connecticut bar. In 1857 he became editor of the *Evening Press* at Hartford, and at the beginning of the Civil War enlisted as a lieutenant in the Union army. For efficient service at Bull Run he was raised to lieutenant colonel. Subsequently he took part in the battles of Port Royal, Fort Pulaski, and James Island, becoming brevet major general, and was mustered out in 1866. He was elected Governor of Connecticut in the same year. In 1872 he was elected to Congress as a Republican and was twice reëlected. Shortly after he was chosen a United States Senator, being reëlected in 1887, 1893, and 1899. He served as president of the centennial commission in 1876, giving valuable aid to the exposition in Philadelphia.

HAWTHORN (hạ'thôrn), a shrub or small tree found in Europe and Asia, but naturalized in many parts of North America. The plant reaches a height of 25 feet, has deciduous leaves, and bears crimson flowers. It produces a red fruit with yellow pulp which remains on the tree after the leaves fall off in autumn. The hawthorn is cultivated to some extent as a hedge, since it bears pruning, and the fruit is used in making a fermented liquor. An American plant, the *thorn apple,* belongs to the same genus of plants.

HAWTHORNE, Julian, author, son of Nathaniel Hawthorne, born in Boston, Mass., June 22, 1846. He was educated at Harvard University. Later he studied engineering in Dresden, Germany, but discontinued his work there on account of the Franco-German War, and became connected with General McClelland's staff of engineers on the New York docks. His first contributions to American magazines were made in 1872, and shortly after he returned to Germany, where he drew inspiration for much of his work in literature. He visited Europe again in 1889 in connection with a delegation of workingmen for the purpose of studying the industries of Europe. Hawthorne produced many valuable magazine articles and other writings, mostly novels. Among his best known productions are "Saxon Studies," "A Fool of Nature," "Trial of Gideon," "Confessions of a Convict," "American Literature," "Professor's Sister," "Another's Crime," "Confessions and

Criticisms," and "History of the United States." His "A Fool of Nature" secured the prize of $10,000 offered by the New York *Herald* in 1896.

HAWTHORNE, Nathaniel, eminent author, born in Salem, Mass., July 4, 1804; died in Plymouth, N. H., May 18, 1864. His grandfather, Daniel Hawthorne, was a naval officer during the Revolutionary War and his father, Nathaniel Hawthorne, was a seaman and died when young Nathaniel had reached the age of four years. He graduated with the poet Longfellow from Bowdoin College in 1825 and was an intimate friend of Franklin Pierce. After leaving college, he adopted hermitlike habits that clung to him ever after. In 1828 he published "Fanshawe," his first novel, which attracted some attention, though he never acknowledged its authorship. "Twice Told Tales" appeared in 1837. It attracted much attention and was praised by Longfellow in the *North American Review.* The following year he received an appointment as weigher in the Boston customhouse and in 1842 married Susan Peabody, of Salem, Mass. President Pierce appointed him consul to Liverpool, which position he filled from 1853 to 1857. Hawthorne is noted for high moral power combined with an artistic finish and exquisite literary style. Many of his later writings were finished in Europe, where he spent seven years, and returned to America in 1860. Among his productions not mentioned above are "The Scarlet Letter," "Mosses from an Old Manse," "The House of the Seven Gables," "The Marble Faun," "Wonder Book," "Snow Image," "Tanglewood Tales," "Blithedale Romance," "Life of President Pierce," "Our Old Home," "Grandfather's Chair," and "Legends of the Province House." Hawthorne was buried in Sleepy Hollow cemetery, Concord, where also are the graves of Thoreau and Emerson.

NATHANIEL HAWTHORNE.

HAY, the stems of grasses and other plants cut and dried for fodder. The United States is the principal hay-producing country of North America. It has an area of 42,500,000 acres cultivated in hay, which yields an annual product of 65,500,000 tons, the crop being valued at $450,500,000. Among the states producing the largest crops of hay are Iowa, New York, Kansas, Pennsylvania, Missouri, Illinois, and Nebraska, but the annual output varies largely on account of the difference in the amount of rainfall, it being quite necessary that the early part of the growing season be favored with an abundance of moisture. Canada holds a high rank in the output of hay, the largest yield being in Ontario and Manitoba.

The best quality of hay from the different plants is secured when the saccharine matter is most abundant, which occurs when they are in full bloom. The grasses are harvested by mowing machines, which cut swaths four to six feet wide. On large farms the hay is allowed to cure a short time and is then tedded mechanically and loaded on wagons by means of machinery, to be stored in stacks or haymows. In many of the larger western hayfields it is customary to push the hay by means of hay sweeps to the stacks, where it is lifted by horse power under roofing. To obtain a nutritive quality of hay it is necessary that the weather be dry, since grasses are more or less damaged by moisture in the process of curing, and thereby lose much of their flavor and nutritive qualities. Timothy, clover, alfalfa, red top, and native grasses are the chief plants utilized to make hay. Other plants that yield hay include oats, barley, cowpea, vetch, and orchard grass. Some plants, such as clover and alfalfa, yield *rowen,* which is made by cutting the second growth or aftermath.

HAY, John, author and diplomat, born in Salem, Ind., Oct. 8, 1838; died July 1, 1905. When twenty years of age, he graduated from Brown University. He was admitted to the Illinois bar in 1861 and was soon after made assistant secretary to President Lincoln. Later he became adjutant and aid-de-camp to the President, and attained to the rank of colonel by serving in the field under Generals Hunter and Gillmore. From 1865 to 1868 he served as secretary of legation at Paris and Vienna. In 1870-75 he was on the editorial staff of the New York *Tribune* and in 1879 became Assistant Secretary of State under President Hayes, but two years later resumed work on the New York *Tribune.* President McKinley appointed him ambassador to England in 1897, and in 1898 he was made Secretary of State to succeed William R. Day. In 1901 he negotiated the Hay-Pauncefote Treaty concerning the canal across the Isthmus of Panama. Subsequently he took part in negotiating a new treaty with Spain and one with Denmark for the cession of the Danish West Indies. Among his well-known writings are "Life of Abraham Lincoln," "Pike

JOHN HAY.

County Ballads," "Castilian Days," and a translation of Castelar's "Republican Movement in Europe."

HAYDEN (hā'd'n), **Ferdinand Vandeveer,** explorer and geologist, born in Westfield, Mass., Sept. 7, 1829; died Dec. 22, 1887. He graduated from Oberlin College and subsequently studied medicine at the Albany Medical College. In 1853 he explored the "Bad Lands" of Dakota and some sections of the Rocky Mountains, and subsequently made extensive surveys in the vicinity of the Upper Missouri. In 1862 he became a surgeon in the United States army and was mustered out of service at the close of the war with the brevet of lieutenant colonel. He became professor of mineralogy and geology of the University of Pennsylvania in 1865, but in the meantime made several exploring expeditions, and in 1872 again joined the government geological survey. He published a number of important reports, in which he set out many facts in regard to the resources and possibilities of the western sections of the United States.

HAYDN (hā'd'n), **Joseph,** celebrated German composer, born in Rohrau, on the border of Austria-Hungary, April 1, 1732; died May 31, 1809. His father was a wheelwright, and, owing to the remarkable musical talent of his son, gave him all possible encouragement. When but eight years old, he was appointed a member of the choir at Saint Stephen's Church, Vienna, but an impairment of his voice caused him to lose his place as chorister at the age of sixteen. He soon earned a small competence, sufficient to rent a piano. This enabled him to continue his studies and at the same time to give private lessons to a large class of pupils. Herr Kurz, a theatrical manager, was attracted by his musical talent and employed him to write an opera. In 1761 he became musical director to Prince Esterhazy, a position he held until 1790, during which time he composed twelve operas and 120 symphonies for the orchestra, besides many other productions of value. In 1790 he visited various European cities, including Berlin, Paris, and London, and two years later returned to Vienna much benefited financially. His productions were prepared with much care and quite slowly, but, being an incessant worker, his compositions are exceedingly numerous. The symphony and the stringed quartette were originated by him. Among the most excellent of his many works are "Orpheus and Eurydice," "Creation," "Seasons," "Haydn's Farewell," "Paradise Lost," and "Seven Words of Our Savior on the Cross."

HAYDON (hā'dŭn), **Benjamin Robert,** painter, born at Plymouth, England, Jan. 26, 1786; died June 22, 1846. He was a pupil of the Royal Academy, London, and was the first of the English artists to recommend the purchase of Elgin Marbles. In 1809 he completed his "Death of Dentatus," for which he received a prize of $500. He had a quarrelsome disposition, hence many influential people became unfriendly to him and he did not receive the credit that he should have had for his paintings. His painting entitled "Christ's Entry Into Jerusalem" is one of his most noted productions and secured for him awards amounting to $15,000. Other paintings include "Banishment of Aristides," "The Raising of Lazarus," "Christ's Agony in the Garden," "Judgment of Solomon," and "Nero Watching the Burning of Rome."

HAYES (hāz), **Isaac Israel,** Arctic explorer, born in Chester County, Pennsylvania, March 5, 1832; died in New York City, Dec. 17, 1881. In 1853 he graduated from the medical department of the University of Pennsylvania and the same year sailed as surgeon of the second Grinnell expedition in search of Sir John Franklin. In 1860 he sailed with two astronomers and twelve other persons on board of the *United States* in search of an open polar sea, securing aid through the influence of several scientific societies. From 1862 to 1865 he was surgeon of volunteers in the Civil War, obtaining the rank of brevet lieutenant colonel by valued service. He made a voyage to the Arctic region in 1869, and succeeded in making a number of valuable discoveries, thus supplementing those made on his second voyage in 1860. He published "The Open Polar Sea," "An Arctic Boat Journey," "Cast Away in the Cold," and "The Land of Desolation."

HAYES, Rutherford Birchard, nineteenth President of the United States, born in Delaware, Ohio, Oct. 4, 1822; died in Fremont, Ohio, Jan. 17, 1893. The death of the father in 1822 left his mother in modest circumstances, but he secured a good elementary education in the common schools. Later he studied at an academy in Norwalk, graduated from Kenyon College in 1842, and completed the course at the Harvard College Law School in 1845. Soon after he began to practice law at Lower Sandusky, but removed to Cincinnati to practice his profession in 1850. He was city solicitor in 1859-61 and in the latter year was commissioned as major in the Civil War. He distinguished himself in the campaigns of West Virginia and at Winchester, was severely wounded at South Mountain, and rose to the rank of brevet major general. In 1864-66 he served as member of Congress, was Governor of Ohio from 1867 to 1871, and was elected a third time in 1875.

RUTHERFORD B. HAYES.

The Republican party nominated Hayes for President in 1876, and, after an exciting campaign, both parties claimed the election. To settle the prolonged dispute that arose, Congress

appointed an electoral commission, which decided by a vote of eight to seven in favor of the Republican electors. The vote of the commission was strictly on party lines, which gave Hayes a majority of one in the electoral college. The Democratic nominee, Samuel J. Tilden, received 4,284,885 of the popular votes and 4,033,950 votes were cast for Hayes. Many of the adherents of Tilden claimed his election, from which the terms president *de facto* and president *de jure* arose, the former meaning actual as distinguished from rightful and the latter meaning by right. Among the events of the administration of President Hayes are the withdrawal of United States troops from North Carolina and Louisiana, civil service reform, and financial legislation designed to strengthen the public credit and to relieve the country from the panic of 1873. At the expiration of his term he returned to his home in Fremont, Ohio, and withdrew from public service. He was the recipient of various distinctions, among them degrees conferred by Kenyon College, Harvard University, Yale College, and Johns Hopkins University. He was honored by positions in many scientific, charitable, and educational societies. These marks of recognition were conferred upon him largely for his work as member of the Peabody Education Board and as president of the National Prison Association.

HAY FEVER, an affection that is similar to a severe cold, sometimes called hay asthma or autumnal catarrh. It is so called for the reason that it affects some people in July, at the time of the haying season, but is more prevalent in August. It usually disappears in October, or on the approach of autumn. The disease is characterized by sneezing and discharges from the nose and the patient usually has weeping eyes, headache, irritability, slight fever, and a loss of appetite. Those affected are likely to have it with more or less regularity every summer. It is caused by the pollen of some plants or the dust arising from molding vegetation, and in some persons is due to nasal deformity. The disease seems to be more violent in America than in Europe, and the best method of obtaining relief is to change climate. Hay fever patients usually find it advisable to go to higher altitudes or a region that has a colder climate than the place of their residence.

HAYNE (hān), **Robert Young,** statesman, born in Saint Paul's parish, South Carolina, Nov. 10, 1791; died Sept. 24, 1839. He was admitted to the bar at the age of 21, served with distinction in the War of 1812, and practiced law at Charleston. From 1814 to 1818 he served as a member of the Legislature, was attorney-general of the State in 1818-22, United States Senator in 1823-32, and was elected Governor in the latter year. Both in the National and State legislative bodies he was a strong advocate of State rights, which in the former led to the famous debate between himself and Webster. In 1832 he was chairman of the State convention in South Carolina that reported the nullification ordinance. As a speaker he ranked among the most brilliant of his time.

HAY-PAUNCEFOTE TREATY, the name of a treaty negotiated in 1901 between the United States and Great Britain. It was so named because John Hay acted for the former and Lord Pauncefote for the latter country. Its purpose is to control the policy of the United States in the construction and maintenance of a canal between the Atlantic and Pacific oceans. This treaty gives to the United States control of the canal, vesting the sole power of guarantee of its neutrality in this country. Under this treaty the work was taken up and promoted without interruption.

The Hay-Pauncefote Treaty was agreed upon by the two representatives on Nov. 18, 1901, and was transmitted by President Roosevelt to the Senate on December 5th, in which body it met some resistance but was duly ratified on December 16th. The following provisions are contained in this treaty:

I.—The Clayton-Bulwer Treaty is abrogated, but the neutralization of the canal is maintained on the same basis as the Suez Canal.

II.—Neither Great Britain nor any other power is to guarantee neutrality of the canal, but it is to be constructed and managed by the United States.

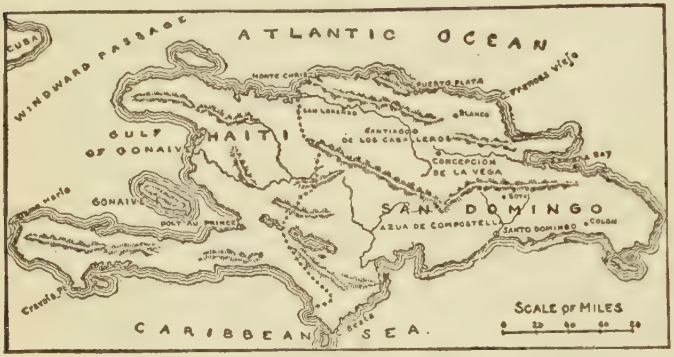
III.—The canal is to be free and open to all nations for commercial purposes, but the United States is allowed certain undefined rights of control in time of war. While the canal must be kept open and free from blockade, the United States is permitted to erect fortifications with the view of commanding the canal, or its adjacent waters, and it may maintain a military force to protect it against lawlessness.

HAY RIVER, a river of Canada, rises in the northeastern part of British Columbia, and after a course of 350 miles flows into Great Slave Lake. It has a general course toward the northeast, and in the northwestern part of Alberta passes through Hay Lake. Alexandria Falls, about 250 feet high, occur in its course. It is navigable for small boats about 135 miles.

HAYS, William H., public man, born at Sullivan, Ind., Nov. 5, 1879. He studied at Wabash College and was admitted to the bar in 1892, when he began to practice law in his native city. He was active as a Republican in party councils many years, serving as committeeman and chairman several years, and in 1921 was made Postmaster General by President Harding.

HAYTI (hā'tĭ), or **Haiti,** a republic which occupies the western part of the island of Hayti, the eastern portion being the republic of San Domingo. The island of Hayti is, next to Cuba, the largest of the West Indies. It is separated from Cuba by the Windward Passage and from Porto Rico by Mona Passage. Its length from east to west is 400 miles; width, 155 miles; and

area, 28,250 square miles. The coast lines are irregular and afford good landings for vessels. Much of the surface is mountainous, but there are extensive valleys, savannas, and coast plains. The highest mountain chain trends through the central part, Loma Tina, with an elevation of 10,165 feet, being the culminating peak. The climate, like that of other West Indian islands,



ISLAND OF HAYTI.

is variable, the seasons being designated as wet in May and June and dry during the time of lower temperature, but it ranks as the most healthful of the entire group. Numerous small streams drain the interior, but most of them are swift and only a few are fitted for navigation by small boats. Several large lakes, including Lake Enriquillo, are in the western part. Extensive and valuable forests abound.

Hayti was discovered by Columbus in 1492, when about 2,000,000 natives inhabited the island, but under Spanish rule they were reduced to slavery and many perished. The French settled in the western part in 1630 and secured a cession of that portion from Spain in 1697. Under the leadership of Toussaint l'Ouverture, who was recognized as the generalissimo by the natives, the Negroes led a revolt against France in 1791. An independent republic was established, but this was suppressed by Napoleon in 1801 when Toussaint was captured and deported to France. Another revolt was led by Dessalines in 1803, when he was made emperor, but was assassinated three years later, and Spain again gained possession of the entire island. After many years of war and bloodshed the two portions became separated and now maintain their integrity as independent republics.

The republic of Hayti has an area of 10,204 square miles. In 1917 the country had 45 miles of railways, the principal line being between Cape Haytien and Grande Rivière. The official language is French and the prevailing religion is Roman Catholic. Public schools of an elementary nature are maintained in most of the districts, but are in a backward condition. The government is vested in an assembly of two chambers, the senate and the commune, and a president, whose term is seven years. Among the industries are agriculture, lumbering, commerce, mining, and manufacturing. The soil being productive, agriculture is the principal industry. Among the chief products are rum, coffee, tobacco, cotton, sugar cane, cacao, and many species of tropical fruits. Gold, silver, tin, iron, clay, and granite are the principal minerals. The forests yield logwood, pine, satinwood, mahogany, and dyewoods. Among the domestic animals are cattle, swine, mules and horses. The export and import trade is largely with the United States, Germany, France, and Great Britain. Hayti has extensive pearl and other fisheries, but they have not been developed to their full capacity. A revolution caused great damage in 1915; war was declared on Germany in 1918.

The inhabitants are Negroes and mulattoes, about ninety per cent. being of the former class. Port au Prince is the capital and largest city. Others cities include Cape Haytien, Aux Cayes, Gonaives, and Port de Paix. Population, 1921, 2,429,700. See **San Domingo.**

HAZE, a slight obscuration in the atmosphere, causing objects to appear dim and obscure. When the haze is very dense, it obscures the light of the sun to a considerable extent, and a light haze deadens the blueness of the sky so objects in the distance appear dim or dull. It is due to the presence of small particles of solid matter, which are raised by ascending currents of hot air or by wind. This kind is ordinarily called *heat haze.* The presence of small particles of water or ice give the sky a light gray color, when the haze is said to be *aqueous.* Other forms are those caused by smoke from peat bogs or forest fires, or by the particles of matter thrown into the air during volcanic eruptions. Many parts of India and China are frequented by dust clouds and dust haze is seen frequently in autumn in most countries, especially if the season is somewhat dry.

HAZEL, a class of shrubs or small trees which belong to the genus *Corylus,* widely distributed in North America, Eurasia, and Africa. Twelve recognized species have been described. They bear nuts much favored as food and for the production of hazelnut oil. The larger nuts borne by the hazel tree are called *filberts* and the smaller are known as *hazelnuts.* They have staminate and pistillate flowers and are among the first plants to bloom in the spring. The wood of many species is used for making baskets, hoops, crates, and charcoal, and the roots are serviceable in veneering. The charcoal of the hazel tree is valuable for painting and in the manufacture of gunpowder. A spe-

cies common to Italy yields woods useful in refining turbid wine.

HAZEL.

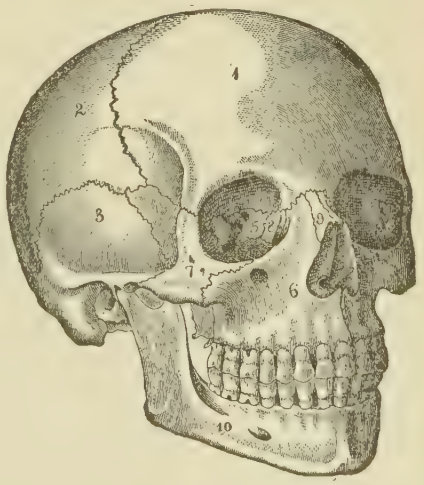
1, Flower. 2, Leaves and Fruit.

HAZEN (hā'z'n), **William Babcock,** soldier, born in West Hartford, Vt., Sept. 27, 1830; died in Washington, D. C., Jan. 16, 1887. After graduating from West Point in 1855, he served against the Indians in California, Oregon, and Texas. He became assistant professor of tactics at West Point in 1861. However, he enlisted in the Civil War, serving in the battles of Shiloh, Corinth, Stone River, and Chattanooga, and accompanied Sherman on the march to the sea. In 1864 he captured Fort McAllister, for which service he was made major general. He became chief signal officer in 1880 with the rank of brigadier general. He published "A Narrative of Military Service" and "The School and the Army in Germany and France."

HAZLETON (hā'z'l-tọn), a city of Pennsylvania, in Luzerne County, 98 miles northwest of Philadelphia, on the Lehigh Valley and other railroads. The surrounding region is noted for its immense production of anthracite coal. It has a State hospital for miners, the Hazleton Seminary, a fine high school, and the Saint Gabriel's Academy. Among the manufactures are ironware, machinery, coffins, brushes, and earthenware. Street railways, telephones, waterworks and pavements are among the improvements. Hazleton was settled in 1820 and incorporated as a city in 1890. Population, 1900, 14,239; in 1920, 32,277.

HAZLITT (hăz'lĭt), **William,** critic and essayist, born at Maidstone, England, April 10, 1778; died Sept. 18, 1830. He studied at a Unitarian college in Hackney, after which he contributed to journals and spent some time in painting. In 1802 he went to Paris, where he copied many pictures in the Louvre, and in the meantime took up literary work. After returning to London, he published his "Essay on the Principles of Human Action." Soon after he began to contribute and write grammatic criticisms for the *Morning Chronicle.* Later he wrote for the *Spectator* and the *Tatler.* For some time he was associated with Leigh Hunt in writing for the *Examiner.* His books include "Characters of Shakespeare's Plays," "Table Talk," "The Plain Speaker," "The Spirit of the Age," "Sketches and Essays," and "Lectures on the Dramatic Literature of Queen Elizabeth."

HEAD, that part of the body of an animal which contains the brain and the organs of the special senses. The head of man has 22 bones, which form a cavity for the protection of the brain and the organs of smell, hearing, sight, and taste. These bones are immovable, except the lower jaw, which is hinged at the back so as to allow the mouth to be opened and closed. The skull bones are composed of two compact plates, with a spongy layer between. These bones are joined at the outer portions by sutures in a way termed dovetailing by carpenters. Within the skull is the delicate brain, peculiarly protected by the oval shape of the bones. The smaller and stronger structure of the skull is toward the front, where danger is greatest, while the spongy packing between the layers serves to deaden a blow that might fall upon the head. Nerves pass through openings in the skull and communicate with the brain. The skull proper consists of eight bones—two temporal, two parietal, and a frontal, occipital, ethmoid, and sphenoid. Fourteen bones constitute the framework of the face, including the vomer and the inferior maxilla, and two each of superior max-



HEAD.

1, frontal bone; 2, parietal; 3, temporal; 4, sphenoid; 5, ethmoid; 6, superior maxillary; 7, malar; 8, lachrymal; 9, nasal; 10, inferior maxillary.

illae, nasal, malar, lachrymal, turbinated, and palate. Many animals of the lower forms of life are destitute of heads.

HEADACHE, or **Cephalalgia,** the name applied to any pain in the upper or back part of the head. In itself it is not a disease, but is a symptom of many widely differing conditions, though the seat of the disease causing the headache may be seated at a place remote from the pain. An unhealthy liver may cause a general headache, while typhoid and many other fevers have a severe headache as a symptom. Those suffering with Bright's disease are frequently sufferers of frontal headache. Gastric dyspepsia, malaria, gout, indulgence in alcoholic beverages, and eye-strain are other prolific causes. Careful diet and regularity in habits should be adopted by persons suffering from an attack, but a skillful physician is needed in chronic headache. Meningitis or brain diseases cause very severe headache and need the most careful treatment. Drugs usually given, such as morphia, aconite, belladonna, quinine, and antipyrine, are frequently very dangerous and tend to produce drug habits. Drugs of this kind should be taken only upon the advice of a physician.

HEALTH, Board of, an organization established and maintained by the government to protect the health of the citizens. Organizations of this kind are maintained in the various political divisions of most countries and are formed on such a basis that the people in all the communities have some form of protection. Local boards of health, such as town and city boards, are more or less subject to the regulations of the state or general boards of health, and the latter work in harmony with various departments of the national government. The function of a State board in most cases is advisory, and its requirements are carried out by the boards of townships and municipalities. A county or parish physician is usually the advisory officer of a township board, while municipal boards are aided by a health officer, who is required to be a physician, and is appointed or elected for that purpose. In most countries, as in the United States, though no national board of health is maintained, the duties devolving upon such an organization is performed under the direction of the Department of the Interior.

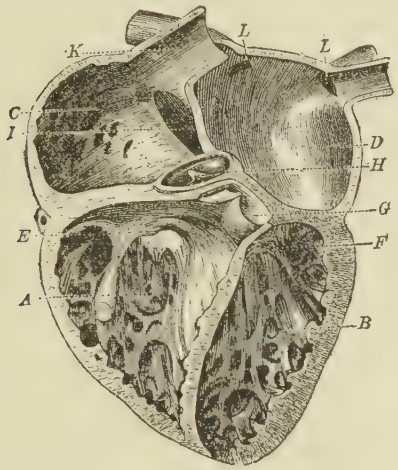
The duty of the board of health is not to provide for the treatment of diseases, but rather to prevent the spread of influences that are harmful to health in a general way. It consists mainly in enforcing vaccination and quarantine regulations to prevent the spread of contagious diseases, to prevent fraud in preparing medicine and food, to control drainage and plumbing, to look after the ventilation and fire escapes of buildings, to regulate the slaughtering of animals, to provide for the removal of dirt and filth, and to consider and direct in regard to any matter that may injuriously affect the health of the community. In many cases the local board of health has exclusive charge of disinfecting the buildings in which patients were treated for contagious diseases, and in some instances provide for medical treatment of those unable to secure a physician. See **Hygiene.**

HEARST (hẽrst), **William Randolph,** public man, born in San Francisco, Cal., in 1863. His father, George F. Hearst, was United States Senator from California. He attended the public schools of his native city and studied at Harvard University. In 1886 he bought the San Francisco *Examiner* and in 1895 acquired ownership of the New York *Journal,* which he made the most widely read newspaper in North America. Later he founded the Chicago *Examiner* and bought the Baltimore *American,* and served as Representative for the 11th New York district in the 58th and 59th congresses. In 1904 he was an unsuccessful candidate for the Democratic nomination for President, was president of the National League of Democratic Clubs, and in 1905 was defeated on the municipal ownership ticket for mayor of New York by Geo. B. McClellan. The following year he was a candidate for Governor of New York against Charles E. Hughes, but was defeated. In 1908 he supported the Independent party and in 1912 the Democrat party in the presidential election.

WILLIAM R. HEARST.

HEART, the organ that propels the blood and causes it to circulate through the arteries, veins, and capillaries. It is muscular, pear-shaped, and about the size of the fist. The heart has four chambers, the two upper being called *auricles* and the two lower, *ventricles.* The auricles are receiving chambers and the ventricles are expelling chambers, but the auricles and ventricles on each side communicate with each other, while the right and left halves of the heart are distinct and perform different offices. The red blood is propelled by the left side and the dark blood by the right. In man the heart hangs point downward in the left central part of the chest and is inclosed by a loose sack of serous membrane, called the *pericardium.* It is held in place by the attachment of the pericardium to the diaphragm and by the large blood vessels that communicate with it. The heart has an alternative contraction and expansion movement; the former is called the *systole* and the latter the *diastole.* Blood flows into the heart during the diastole movement and is expelled by the systole. The beating of the heart is due to these movements and may be distinctly heard between the fifth and sixth ribs.

The impure blood coming from the system enters the *right auricle* through the *inferior* and *superior vena cava,* thence passes into the *right ventricle* through the *tricuspid valve,* and is then driven past the *semilunar valves* through the *pulmonary artery* to the lungs to be purified. It next returns as bright-red blood through the four *pulmonary veins* to the *left auricle,* is forced past the *bicuspid valve* to the *left ventricle,* and is driven through the *semilunar valves* into the *great aorta,* whence it passes into the general circulation.



HEART.

A, right ventricle; *B,* left ventricle; *C,* right auricle; *D,* left auricle; *E,* tricuspid valve; *F,* bicuspid valve; *G,* semilunar valves; *H,* valve of the aorta; *I,* inferior vena cava; *K,* superior vena cava; *L,* pulmonary veins.

HEAT, a form of energy which is generated by the transformation of some other form of energy, as by chemical action, combustion, or the stoppage of mass motion by friction. All bodies possess some heat, since *cold* is merely a relative term, but the degree of heat which is known as *temperature,* differs greatly in various forms of matter. Heat possesses the power of vaporizing, expanding, melting, and decomposing bodies. It has the effect of raising the temperature of objects and of passing through space with the velocity of light. It may be manifested as light, as temperature, and as chemism, or in all of these ways at the same time.

The theory of heat now generally accepted is that of Macedonio Melloni (1798-1854), an Italian physicist. This theory is called the *theory of undulation,* and supposes that heat is caused by a vibratory or oscillatory motion of the particles of the body and is a condition of matter, not a substance. The hottest bodies are those in which the vibrations move quickest through the widest space. The theory implies that the molecules of solid bodies are in constant vibration. When this oscillation is increased, the body becomes heated; when it is decreased, the body is cooled. Ether fills the vacant spaces between the molecules. The ether puts the molecules in motion, or it is thrown into vibration by them, in the same manner as the air moving through the leaves of a tree sets its boughs in motion, and in turn may be kept in motion by the waving of branches. The sources of heat are chemical and mechanical energy, the stars, and the sun.

That friction and percussion produce motion may be illustrated in bringing a moving mass in contact with one at rest, by which the motion of the mass is changed into motion among molecules. Chemical action is seen in fire, in which the oxygen of the air has an affinity for the carbon and hydrogen of the fuel, and, by combining the chemical energy, there is a transformation into that of sensible heat. The cause of heat coming from the sun and stars is the rapid vibration of the molecules. By them waves of ether are set in motion, which are propagated across the intervening space, and give up their motion when they meet the earth. The effect of heat upon all solid, liquid, or gaseous bodies is to expand them, while a material reduction of the temperature causes them to contract. This gives rise to the popular term, "Heat expands; cold contracts." The only partial exception to the rule is water (q. v.). At a certain temperature heat vaporizes liquids, but in solids it produces fusion. By conduction and radiation it may be transmitted to other bodies. The term *radiated heat* implies the heat produced by radiation, which gives rise to the terms thermal ray, ray of heat, and calorific ray, these being used in correspondence to the terms luminous ray and ray of light.

In propagating radiate heat from a hotter to a colder body the intervening medium is not heated. Both heat and light are transmitted by the same medium. They are similar in that they are the vibrations of an elastic medium, obey the same laws of reflection, interference, refraction, and polarization, and are subject to the general laws of wave motion. Two bodies placed in contact with each other give off heat to each other. If they are equally hot, the exchange of heat is mutual, and it appears as if no heat passes between them, and they are then said to be of the same temperature. However, if one of them is more highly heated than the other, it gives more heat than it receives, and is therefore at a different temperature. Instruments used to measure temperature are called *thermometers.* Different scales or units of measurement may be adopted for measuring heat and various chemicals, such as mercury and spirits, serve in the preparation of thermometers. The branch of science that treats of the measurement of quantities of heat is called *calorimetry.*

HEATH (hēth), the common name of any plant of the heath family, which includes about 500 species. They are widely distributed in Europe and South Africa, but only a few spe-

cies are native to North America. The common heath of England, a low evergreen shrub with small leaves and clusters of rosy flowers, is found chiefly on the waste lands. It grows in beds on the sides of mountains, and the stems are from three to four feet in length. The flesh-colored heath is found on the mountains of Europe. In this plant the leaves come out early in the spring, causing it to be looked upon as a harbinger of the growing season. Several species native to South Africa are cultivated extensively as greenhouse plants and are favorites for the beauty and variety of their flowers. Small tracts of land in which small evergreen shrubs comprise the dominant plant types are commonly called *heaths*. Small regions of this kind are found in Canada and the northern part of the United States, in which the junipers and bearberry are the prevailing plants. The huckleberry, cranberry, and trailing arbutus are familiar species allied to the heath.

HEAVEN (hĕv"n), in science, the expanse which surrounds the earth and seems like a great dome or arch containing the sun, moon, and stars. It appears to rest on the horizon, and is in reality merely the aspect that a spectator sees when looking into the immeasurable space of the universe. In theology, heaven signifies the abode of God, where the Most High and the angels dwell and are especially manifest. Among the Jews heaven is regarded as the special abode of God and it is held to be high above the earth. Christians believe that Christ came from heaven, and, after fulfilling His mission on earth, returned there to prepare a place for the saved. Those who reach heaven shall not experience hunger or thirst, nor feel undue heat nor any sorrow. This condition is to be reached after the resurrection, when mortality shall become immortal and incorruptible.

HEAVES. See **Broken Wind.**

HEAVEYSEGE, Charles, poet, born in Liverpool, England, in 1816; died July 14, 1876. He first learned the trade of a cabinetmaker and afterward engaged in journalism. In 1853 he removed to Canada and for some time was an editorial writer for the Montreal *Witness*. His best work, entitled "Saul," is a tragedy in three parts. He produced a number of works that were dramatized and became popular in Canada and the United States. His writings include "The Dark Huntsman," "Count Filippo," "Jephthah's Daughter," and "The Revolt of Partarus."

HEBE (hē'bē), in mythology, the most attractive and joyous personification of eternal youth. She was the daughter of Zeus and Hera, a maiden with sparkling eyes, beautiful form, and modest in appearance. She was cupbearer to the gods, but on account of an accident was deprived of her office and succeeded by Ganymede. Later she became the bride of Hercules and was received among the immortals.

HEBEL (hā'bĕl), **Johann Peter,** German poet, born in Basel, Switzerland, May 11, 1760; died Sept. 22, 1826. He was educated at Carlsruhe and Erlangen, where he gave early evidences of much ability. In 1791 he was appointed professor of theology and Hebrew at Carlsruhe. He published "Allemanian Poems" and "Bible Stories." For a number of years he was editor of the *Rhineland House Friend*. His complete works were published in eight volumes in 1832-34.

HEBER (hē'bĕr), **Reginald,** poet, born in Malpas, England, April 21, 1783; died in Trichinopoli, India, April 3, 1826. He was educated at Oxford, became a clergyman, and spent many years in India, where he was second bishop of Calcutta. His writings hold a high place in English literature. He is the author of "Palestine" and many other well-known hymns. In 1805 he became a fellow of All Souls and later was appointed Bampton lecturer at Oxford. "The Personality and Office of the Christian Comforter" is his chief work in prose. Among his hymns are the familiar "From Greenland's Icy Mountains," "Lord of Mercy and of Might," and "Lo, He Comes in Clouds Descending."

HEBERT (ā-bâr'), **Jacques René,** public man, born at Alençon, France, Nov. 15, 1755; died March 24, 1794. He was called "Le Pere Duchene," which was the name of a radical paper published by him during the French Revolution. In 1792 he became a member of the commune, and the following year was active as an opponent of the Girondist party. Soon after he was appointed a member of the commission to examine Marie Antoinette, whom he accused of malicious and unreasonable offenses. He was arrested in 1794 and tried under the direction of the Committee of Public Safety, and both he and his wife were guillotined.

HÉBERT, Louis Philippe, sculptor, born at Sainte Sophie d'Halifax, Quebec, Jan. 27, 1850. He spent his early life working on a farm, but in the meantime studied wood carving. In 1873 he attended a studio in Montreal and subsequently spent some time in Paris. He won the prize given by the Dominion for a full-length statue of George Cartier, and subsequently produced a number of historical statues for buildings in Montreal, Ottawa, and Quebec. In 1894 he obtained a medal from the government of Canada. His statues of Chénier and Maissoneuse, now in Montreal, are among his finest productions.

HEBREWS (hē'brŭz). See **Jews.**

HEBREWS, Epistle to the, one of the canonical books of the New Testament. It was addressed to the converted Jews for the purpose of fortifying them in the Christian faith. The chief purport of it is to demonstrate the preëminence of Christ over Moses and the angels and of the Gospel over the law, and to show that the latter was typical of the former and was abolished by it. Luther suggested Apollos as the author, and this view was held by a number of prominent Christian writers. However, the

Greek fathers ascribed the authorship to Paul, though no Latin writer attributed it to him until about the 4th century.

HEBRIDES (hĕb'rĭ-dēz), or **Western Islands**, a chain of islands off the western coast of Scotland. The total number includes about 500 islands and islets, of which only 90 are inhabited. They are classed in two groups, known as the Outer and the Inner Islands. Barra, North Uist, South Uist, Benecula, and Saint Kilda belong to the Outer Islands, while Skye, Mull, Jura, Coll, and Tiree belong to the Inner Islands. They belong to the counties of Inverness, Ross, and Argyle. The climate is humid and the soil is largely poor. Agriculture, cattle rearing, and fishing are the principal industries. The Hebrides were colonized by the Norwegians in the 9th century and remained subject to Norway until 1266, when they were annexed to Scotland. They were governed by chiefs for a number of decades, who assumed the title of *Lord of the Isles*, and were made a crown possession of Scotland in 1540. Population, 1922, 98,045.

HEBRON (hē'brŭn), an ancient city of Palestine, located in the valley of Eschol, twenty miles south of Jerusalem. It is situated in the region which anciently belonged to the tribe of Judah. The streets are narrow and crooked. It has tombs which are alleged to be those of Abraham, Isaac, Jacob, and others of the patriarchs. The surrounding country is noted for its fruits, especially grapes and olives. Abraham and David resided in Hebron a number of years. It was captured by Saladin in 1187. Population, 1922, 19,020.

HECATE (hĕk'â-tē), a goddess of ancient Greece, commonly called a daughter of Perses, one of the Titans, and of Asteria. She had the power of bestowing victory, wealth, and wisdom upon mortals and was equally dominant in the sea, on earth, and in Heaven. This extensive jurisdiction caused her to be confounded with other divinities, such as Ceres, Diana, Rhea, and Proserpine. Her worship was conducted chiefly at Athens and Aegina, where statues of her were placed in front of houses. Honey, eggs, and lambs were her favorite sacrifices. She is represented in art both as a single being and as a three-headed monster, and about her neck are serpents and wreaths.

HECLA (hĕk'lâ), or **Hekla**, an Icelandic volcano, situated 20 miles from the southwestern coast, elevated 5,100 feet above sea level. It is covered with snow perpetually, contains several craters, and is composed largely of lava and basalt. The most extensive eruption on record occurred in 1783, when a stream of lava was thrown out which extended a distance of 45 miles and was 15 miles wide. Other notable eruptions were those of 1845 and 1878. The discharges consist largely of ashes, lava, and masses of pumice stone.

HECTOR (hĕk'tẽr), the defender of the city of Troy and bravest of the Trojan warriors. He was the son of King Priam and his second wife, Hecuba, husband of Andromache, and father of Scamandrius and Astyanax. The "Iliad" of Homer gives an account of his success over Patroclus, the friend of Achilles, and of the revenge sought by the latter. These two warriors met before the walls of Troy in mortal combat, which resulted in the death of the valiant Hector. In the "Iliad" is an attractive account of Hector, which describes the combat between him and Achilles, and details the incident of dragging his body at the chariot wheels of the conqueror. It gives an account of the deliverance of the body to Priam for ransom and the solemn and impressive burial. The parting from Andromache before his last combat is an episode of especial beauty.

HECUBA (hĕk'ŭ-bâ), the second wife of Priam, King of Troy. She was the daughter of the King of Thrace and became the mother of the valiant Hector, of the Prophetess Cassandra, and of Paris, who was the immediate cause of the Trojan War. Her husband, Priam, and all but one of her sons were killed in the war with the Greeks. When Troy fell, she was made the slave of Odysseus, and because of cruelties became despondent and leaped into the Hellespont. The tragedy of Euripides, "Hecuba," is founded on this story.

HEDGEHOG (hĕj'hŏg), a mammal native to Eurasia and Africa, belonging to the insectivorous animals, and remarkable for its covering of spines instead of hair. It has small black eyes and short legs. The body is about ten inches long. It defends itself against its enemies by contracting special muscles whereby it

HEDGEHOG AND YOUNG.

is rolled into a ball, causing the spines to stand quite rigid. The hedgehog inhabits small thickets and feeds on insects, worms, snails, and sometimes on vegetable matter, which it seeks at night. During the winter it hibernates. From three to eight young are born in a litter. The spines develop soon after birth. Fourteen species have been described, most of which have

only a rudimentary tail and none is native to America or Australia. A closely related spine-bearing mammal, called the Canada porcupine, is native to the northern part of North America.

HEGEL (hā'gĕl), **Georg Wilhelm Friedrich,** philosopher, born in Stuttgart, Germany, Aug. 27, 1770; died in Berlin, Nov. 14, 1831. He was educated at the University of Tübingen, became a family tutor at Bern and Frankfort-on-the-Main, and in 1801 settled at Jena, where he formed an intimate friendship with Schelling. Until 1808 he was connected with a newspaper at Bamberg, but in that year he became rector of the Nuremberg Gymnasium. In 1816 he was elected to a professorship at Heidelberg and two years later at Berlin, where he remained until his death. In thought and argument, Hegel was methodical and painstaking, acute in reasoning, and precise in analyzing. He did not publish any writings until 1801, when an essay on the philosophy of Fichte and Schelling appeared. Soon after he settled at Jena, where he gave expression to many of his views in the *Critical Journal of Philosophy,* a periodical published jointly by him and Schelling. The celebrated work, "Phaenomenology of the Spirit," was published in 1807, by which he attained a marked reputation among the scholars of his time.

The greatest work of Hegel was published in 1812 under the title "The Culture of Logic." It was followed in 1816 by his "Encyclopaedia of Philosophical Culture." While at Berlin he wrote a large number of philosophical works, and gave to the world many valuable treatises on the so-called ideal school, of which he and Kant, Fichte, and Schelling were the promoters. His writings not mentioned above that are particular noteworthy include "The Philosophy of Right," "The Philosophy of Art," "The Philosophy of Religion," "The Philosophy of History," and "The History of Philosophy." However, a number of these appeared as lectures before their publication in book form. Hegel was a successful teacher, inspired the confidence of his pupils, and maintained discipline without interfering with their sports and associations. His "Encyclopaedia of Philosophical Culture" presents a complete outline of the Hegelian system as a whole. William T. Harris, formerly Commissioner of Education in the United States, published an exposition of the doctrines of Hegel under the title "The Logic of Hegel."

HEGIRA (hĕ-jī'rà), **Hejra,** or **Hijra,** an Arabian word, meaning *going away,* and used to describe the flight of Mohammed from Mecca on Sept. 13, 622 A. D. This is the beginning of the Moslem era. A calendar made by Caliph Omar in 639 begins with the first day of the month in which the flight occurred. The Moslem year consists of 354 days and 9 hours, hence is about 11 days shorter than the Gregorian year. This makes it difficult to reduce the Christian to the Mussulman year, but it may be roughly done by subtracting 40 from the former and adding 622 to the remainder. Since 1328 of the Hegira corresponds to the year 1910, it will be seen that 1328—40+622=1910.

HEIDELBERG (hī'dĕl-bĕrg), a city of Germany, in the grand duchy of Baden, on the Neckar River, ten miles southeast of Mannheim. It occupies a beautiful site in a valley between the river and the slope of the Königstuhl, an elevation 1,860 feet high, and has several beautiful streets. The noteworthy buildings include a castle of much beauty begun in the 13th century, the Church of the Holy Ghost, the Church of Saint Peter, the city hall, the public library, and the University of Heidelberg. Among the manufactures are musical and scientific instruments, fabrics, clothing, and machinery. The celebrated Heidelberg tun is kept under the castle. It has a diameter of 26 feet, a length of 36 feet, and a capacity of 50,000 gallons of wine. Heidelberg has many beautiful parks, electric lights and street railways, pavements, and extensive railroad connections. The city dates from the latter part of the Middle Ages and suffered much during the Reformation. In 1803 it was annexed to Baden. Population, 1915, 49,527.

HEIDELBERG, University of, a famous institution of higher learning at Heidelberg, Germany, founded by Elector Rupert I. in 1386. Although a Roman Catholic center of learning at the beginning, it became a powerful influence of the Protestants in the 16th century. Here Melanchthon preached the reformed faith. The 500th anniversary of the university was celebrated with imposing ceremonies in 1886. It has a library of 500,000 volumes, a faculty of 160 instructors, and an attendance of about 1,600 students.

HEILBRONN (hīl-brŏn'), a city of Germany in Württemberg, 32 miles north of Stuttgart. It is located on the Neckar River, which is navigable at this place, and is at the junction of several railways. Among the chief buildings is the Church of Saint Kilian, a Gothic structure of the 11th century. It is the seat of a gymnasium, a school of agriculture, a large public library, and a meteorological observatory. The chief manufactures include sugar, jewelry, salt, cigars, chemicals, and machinery. It has a large trade in groceries, coal, merchandise, and farm produce. Near it are several mineral springs, which were visited by Schiller and a number of prominent sovereigns, including Gustavus Adolphus and Charles V. Heilbronn became a free city in 1360. It suffered greatly during the Thirty Years' War. Since 1802 it has belonged to Württemberg. Population, 1920, 42,709.

HEILPRIN (hīl'prĭn), **Angelo,** naturalist, born at Sátoralja-Ujhely, Hungary, March 31, 1853; died July 17, 1907. He was brought to the United States in 1856, where he secured the elements of an education, and subsequently studied in London, Geneva, and Vienna. In 1884 he was made professor of paleontology and geology at the Academy of Natural Sciences, Philadel-

phia, where he taught successfully until 1900. In the meantime he made several visits to Europe and conducted expeditions for scientific research to the Bermuda Islands, Florida, and Alaska. In 1902 he visited Martinique to study the eruption of Mont Pelee, and soon after published a valuable scientific account of this phenomenon. He supervised the revision of Lippincott's "Geographical Gazetteer." His works include "Principles of Geology," "Alaska and the Klondike," "Explorations on the West Coast of Florida and the Okeechobee Wilderness," "Geographical and Geological Distribution of Animals," "The Arctic Problem and Narrative of the Peary Relief Expedition," and "Mont Pelee and the Tragedy of Martinique."

HEIMDALL (hīm'dȧl), the son of Odin by a mother of Jötun race, who is said to have kept watch over the Scandinavian gods. He was peculiarly fitted to be the guardian of Asgard, where the gods dwelt, since he was able to hear the grass grow and could see as well by night as by day. The Norse thought that he will sound his jallarhorn to summon the gods when the last conflict is to take place.

HEINE (hī'nę), **Heinrich,** author and poet, born of Jewish parents in Düsseldorf, Germany, Dec. 13, 1797; died Feb. 17, 1856. He first took a course in banking at Frankfort, but in 1819 entered the University of Bonn, and subsequently studied at Berlin and Göttingen, receiving a degree at the latter in 1825. About the same time he joined the Lutheran Church and went upon a visit to the Harz Mountains, Italy, and other European countries for the purpose of studying natural scenery and customs. About this time he published his "Pictures of Travel," based on his observations, which met with extraordinary success. In 1827 appeared his "Book of Songs," many of which are masterpieces of German literature and are exquisite in beauty and thought. The Revolution of 1830 imbued Heine with a spirit of democracy and induced him to write on that subject, but this necessitated his leaving Germany, causing him to settle in Paris, where he supported himself by literary work until his death. He married in 1835. His wife, Mathilde, is mentioned frequently in his writings. In 1837 he was granted a pension by the French government, but it was discontinued in 1848 with the overthrow of Louis Philippe.

Heine devoted much of his time to writings of a political nature, largely because of his personal interest in political affairs. He endeavored to produce a line of works that would acquaint the French with German art and literature, and, if possible, bring about a better feeling between the two peoples. In 1844 he visited his native country to see his mother, and, while there, published "Winter's Tales." The writings of Heine show a warm sympathy for men and are characterized by a vein of humor which often verges on burlesque. Among his writings not named above are "New Songs," "The Newer Literature of Germany," "Doctor Faust," "Youthful Sorrows," "Conditions in France," "The Salon," "Romanzero," "Last Poems and Thoughts," and "Poems and Ballads." He contributed to many periodicals, and was editor of the *General Political Annals,* which was published at Munich.

HEINTZELMAN (hīnt'sęl-măn), **Samuel Peter,** soldier, born in Manheim, Pa., Sept. 30, 1805; died in Washington, D. C., May 1, 1880. In 1826 he graduated from West Point, served as lieutenant against the Indians, and was brevetted major at the beginning of the Mexican War, during which he rendered service in California and on the Rio Grande. In 1861 he was brevetted lieutenant colonel for meritorious service against the Indians in California. Subsequently he commanded in the battles of Bull Run, Williamsburg, and Fair Oaks, and the siege of Richmond. After the war he served in New York and Texas, and was placed on the retired list in 1869 with the rank of major general.

HEIR, in law, one who succeeds to his estate, not by the will of a decedent, but by the death of another. Such inheritance comes to the heir by operation of the law. This may be said to be a restrictive use of the word, since the term is used in some countries to describe the descent of property both by will and by the natural law of descent. An heir is said to be *direct* when the line of descent is direct, as from parents to children or grandchildren. All others, as brothers, sisters, cousins, uncles, etc., are termed *collateral heirs.* One who is certain to inherit property, provided he outlives another, is called an *heir apparent.*

HEL (hĕl), the Scandinavian goddess of the dead, the daughter of Loki by the giantess Angurboda. Her home was in Niflheim, under the roots of Ygdrasil, the mystic ash tree. Helheim is spoken of as her home a part of the time and Hel-way was a long road that led to it, but Hermod covered the distance in nine days and nine nights. This road led downward and northward and was traveled by Odin when he consulted the vala about the fate of Balder. Some of the peasants of Norway still have faith in this goddess. They think that the barking of her dog is a warning of approaching death and the feet of the dead are protected by hel-shoes, known as *hell-shoon.*

HELDER (hĕl'dĕr), a city of the Netherlands, in the province of North Holland, at the entrance to the Zuyder Zee. It is strongly fortified and is protected from the sea by a dike built of Norwegian granite. This dike is five miles long and thirty feet wide at the top. It serves as a roadway from Helder to Nieuwediep, the harbor at the entrance to the North Holland Canal, by which Helder is connected with Amsterdam. The city has a large local and foreign trade. It is the seat of a naval hospital, shipyards, barracks, and magazines, and

a military school. In 1673 it was the scene of a famous battle between the allied fleets of France and England, on one side, and the naval forces of Holland under Tromp and De Ruyter, in which the latter were successful. Population, 1906, 26,982; in 1922, 28,303.

HELEN. See **Helen of Troy.**

HELENA (hĕl'ê-nà), county seat of Philips County, Arkansas, on the Mississippi River, about eighty miles below Memphis, Tenn. It is on surfaced highways, the Missouri Pacific, the Yazoo and Mississippi Valley, and other railroads. The chief buildings include the county courthouse, the high school, and the Southland College. It is surrounded by a fertile country and has a large trade in cotton and lumber. Among its manufactures are shingles, cotton-seed oil, machinery, lumber, and utensils. In 1863 it was the scene of a battle between the Confederates under General Holmes and the Federals under General Prentiss, in which the latter were defeated. Population, 1900, 5,550; in 1920, 9,112.

HELENA, the capital of Montana, county seat of Lewis and Clarke County, in the Prickly Pear valley, about fourteen miles west of the Missouri River. It is on the Northern Pacific and the Great Northern railroads and has intercommunication by electric lines. The site is a fine tract of land, sufficiently rolling to be well drained, and is surrounded on all sides by elevated ridges of the Rocky Mountains. The noteworthy buildings include the State capitol, the public library, the county courthouse, the Federal building, the high school, Saint John's Hospital, and several fine churches. It is the seat of the Montana Wesleyan University, a Methodist Episcopal institution. The surrounding country is agricultural, and contains valuable deposits of gold, silver, ruby, and sapphire. Among the manufactures are harness, vehicles, flour, machinery, implements, lumber, and quartz products. It has extensive machine shops and foundries. Helena was a mining camp in 1864, but was platted the same year and incorporated in 1881. Population, 1920, 12,037.

HELEN OF TROY, the daughter of Zeus and Leda, and wife of Menelaus. Greek legends describe her as a woman of great beauty. It is recounted that she was carried off by Theseus and Pirithous at the age of ten years and that she was recovered by her two brothers, Castor and Pollux. Her thirty suitors included Menelaus, whom she chose as her husband, but Paris, son of Priam, King of Troy, carried her off, an incident which gave rise to the Trojan War. There are numerous stories concerning the fate of Helen, but it is most common to recount of her marriage to Deiphobus, brother of Paris, after the death of the latter. Later Deiphobus was betrayed by her to Menelaus, after which she returned with her husband to Sparta, and subsequent to his death was banished. Among the writers who have taken Helen for a subject are Homer, Virgil, Pausanius, Euripides, and Goethe. Grecian artists represented her in sculpture as the prototype of beauty.

HELFERT (hĕl'fĕrt), **Alexander,** statesman and author, born in Prague, Bohemia, in 1820; died in 1910. His father was a teacher at the University of Prague, where he was assistant several years, and subsequently taught history at the University of Cracow. In 1848 he was elected to the parliament of Austria, was made head of the educational bureau in the state ministry, and edited the *Austrian Year-Book.* As statesman he favored the clerical federal party, of which he was a leader in the house of peers. His many writings include "The Public Schools of Austria," "The Battle of Kulm," "Biography of Marie Louise," "Gregory XVI. and Pius IV.," and "Emperor Francis I. of Austria."

HELGOLAND (hĕl'gô-lánt), or **Heligoland,** an island in the North Sea belonging to Germany, situated 38 miles from the mouth of the Elbe. It is a half a mile wide and two miles long. The area was formerly much larger, but it has been worn away by encroachments of the sea. The coast lines rise perpendicularly from the sea, but the soil is very fertile. It is cultivated largely in orchards and gardens. The fisheries are important, especially those yielding haddock and lobsters, and as a summer resort it is a favorite gathering place. Helgoland is important mainly as a strategic point and was strongly fortified by the German government. In 1807 England forced Denmark to evacuate the island, when it was ceded to the British, and Germany acquired it in 1890. Several naval battles occurred in the vicinity in 1915. Population, 1922, 2,403.

HELICON (hĕl'ĭ-kŏn), or **Sagara,** a mountain range in the southwestern part of Boeotia, Greece, and the fabled resort of the ancient Grecian muses. In these mountains were temples dedicated to the Muses and Apollo. They contained the fountains of Aganippe and Hippocrene, which gave inspiration to the poet Hesiod. Paleo-Vuno, the loftiest peak, is 5,730 feet high.

HELIOPOLIS (hē-lĭ-ŏp'ô-lĭs), meaning city of the sun, the city called On, Bethshemesh, or Rameses in ancient Egyptian writings, but now known as Matarich. It is situated on the Pelusiac branch of the Nile, near the canal which connects that river with the Red Sea, eight miles northeast of the present city of Cairo. Under the Pharaohs it was the most populous city of Egypt, being beautified by lakes and canals that connected it with the Nile, and in it were many temples and schools. These schools were visited by Eudoxus and Plato. Mention is made of the place by Herodotus and Strabo, but in the time of the latter it was little more than a deserted village. It is thought to have been the place where Joseph and Mary found refuge in their exile with the infant Christ. The pillar of On still stands near the present village. The obelisk now in Central Park, New York, was